THE

WESTERN REVIEW OF SCIENCE AND INDUSTRY.

A MONTHLY RECORD OF PROGRESS IN

Science, Mechanic Arts and Agriculture.

VOL. 1. JANUARY, 1878. NO. 11.

CORRESPONDENCE.

THE SAN JUAN MINES.—REVIEW OF THE PAST SEASON.

BY WM. WESTON.

Old Hyems has now closed his icy fist on the above region for 1877, and more especially on the dwellers and miners of the Pacific side of the Snowy Range. Snow has fallen unusually early and in large quantities, and here in the Sneffels District is about three feet on the level at this writing (Nov. 25th.) But though I pen this in a log cabin 10,800 feet above the sea level, have felt no inconvenience either from snow or temperature. If we want to take a trip round the basin to visit one of the three other cabins, whose occupants alone have had the hardihood to brave an eight months' winter in the clouds, we toddle around on Norwegian snow shoes, and it matters little though the snow be three or thirty feet deep. The thermometer has, for the last six weeks ranged between 10° and 20° Fahrenheit, at daybreak, and 30° to 36° at noon, but the air is so light and bracing that cold has not the depressing, chilling effect of lower altitudes. A friend of mine writing from London, England, says: "Your eight months' winter is a terrible weight." We don't find it so. My partner and I have built ourselves a snug log cabin, and well stocked it with "grub," powder and fuse, enough for an eight months' siege, and with plenty of warm clothes, books, drawing, writing, an assay furnace and outfit to test the ores, and our tunnel to

work on during the day, we find the time passes rapidly and enjoyably Winter is *par excellence* the time to work a mine. The warm sun, green hillsides and valleys, and the perfume of a thousand flowers do not tempt you from your work, and you feel quite content to peg away with pick and shovel, sledge and drill, with the bright prospect of being, mayhaps, a millionaire in the spring.

The three principal silver mining districts of the San Juan are the Lake, Animas and Sneffels, and in all of these rapid strides toward improvement have taken place during the past season. In the first the strides seem to have been too rapid, and a rush to Lake City took place early in the spring, which neither the advance of the season or the richness of the mines in the least warranted. Hundreds went there and returned disgusted. They were of two classes—the capitalist, who on arriving there, found snow still deep on the ground and none of the mines to be seen; and the poor deluded wretches, who, misled by the lies published in "one-horse" mining sheets and copied into eastern newspapers by ignorant and careless editors, came in on foot expecting to find silver and gold lying about loose, or to get plenty of work at high wages. The former returned by the first coach—the latter, God knows what became of them—I saw dozens returning hungry and footsore. Lake City had a wagon road to it, and that is what made the place; Silverton, the capital of the Animas district, has none, and the one to Ouray, the only mining camp in this district, has been through Lake City. The consequence was, a tremendous rush to the latter place and it was over-run; a reaction has of course taken place, and it is now as flat as ditchwater.

There are two smelt mills there—Bernard's and Crook's—the former is buying ore, but has not yet made a vein; the latter has shut down and the owner gone out for the winter. There are also lixiviation works there which have been running all summer on ore from this district, packed to Lake City at a cost of $45 per ton. It was principally from the "Wheel of Fortune," whose ore (1st, 2d and 3rd class), has averaged this season 225 ounces of silver to the ton. Twenty tons of ore from this now celebrated mine, ran 800 ounces per ton. So some idea may be formed of the richness of the mines. These lixiviation works have also shut down and the owners gone out to hibernate elsewhere. In the mines around Silverton, great activity has been manifested this season. Greene & Co.'s smelter has been running night and day all summer, and they have sent out between 300 and 400 tons of bullion, averaging $250 per ton. The Cement Creek Chlorination works at Camp Gladstone, seven miles from Silverton, have been erected this season for a London company by Mr. J. H. Ernest Waters, M. E., F.R. S., a graduate of the Royal School of Mines, and an engineer of some distinction in English mining circles. Their machinery is all in, and by this time they have made their trial run. Their capacity is 15 tons per diem; Greene & Co.'s 10. Messrs. Melville & Summerfield's Lightning Amalgation works in Silverton, through some mistake in the management, failed to

give satisfactory results on their trial run, which they were unable to make until near the close of the season, owing to their machinery having been delayed on the range; the proprietors, however, pluckily went to work at once to remedy the evil, and will be running next season early. All this machinery has been brought over the summit of the main range at an altitude of 12,400 feet above tide-water, and with no road; and the want of one is all that holds the district back. I, myself, brought out this spring a young Englishman of wealth, to build this toll-road into Silverton, but as soon as he saw the mines and their richness, he did what others have done before him—threw overboard the legitimate enterprise and went into mining speculations—and so it goes on from year to year. The consequence is, that the people of Silverton and the Animas district, have to depend on pack animals to bring in nearly all the necesssaries of life, and at a cost of about four cents per pound from the end of the Denver and Rio Grande railway. Is not this a millstone round the neck of any people? A Mr. Jones, of New York, who has purchased some mines in Cunningham gulch, and is running compressed air drills in a tunnel of a prospective length of 2,000 feet, has taken the road in hand, and already built it from the Silverton side to near the summit of the range, and intends to complete it early next season. Then the district will "boom," and the hundreds of good mines whose produce is galena, running 40 to 50 ounces silver to the ton (and which is now rated "low grade," and will not pay to work), will be in full blast, and the lead, which is now worthless, will pay the carriage of the ore to St. Louis. Would you believe it, that there are hundreds of tons of ore running say 30 ounces of silver, lying about on the dumps of the mines round Silverton as worthless? Such is the case. What do you suppose Greene & Co. gave for 100 ounce ore? Just $42.00 They are making a fortune each year; and they deserve to, for having the grit to bring all their machinery 180 miles by wagon and pack animals.

It has been estimated that here, within a radius of 20 miles, there are over six thousand silver claims which are only having yearly assessment work done on them, and all owing to the want of roads and smelt mills. The best proof of the want of them is the simple fact that here in the Sneffels district, whose ores are the richest yet discovered in the San Juan country, 100 ounce ore will not pay to work, and is not saleable at this writing.

But year by year a few capitalists find their way into the country, a mill or two goes up, and another road is built, and the time is not far distant (experts say two years), when the man who owns a mine with a pay streak of one foot of solid mineral running 50 ounces of silver to the ton, will be worth a million.

The Sneffels district is yet in its extreme infancy, but the wonderful richness of its ores has made its fame known all over the mining world. In this basin and the adjoining one there are thirteen mines being worked this winter, and the probable output of ore on the dump in the spring will

be from one thousand to fourteen hundred tons, the yield of which will average between 150 and 175 ounces to the ton. Among these are the "Wheel of Fortune," whose first class ore has run as high as 800 ounces, the "Virginius" 230 ounces, and "Yankee Boy" 560 ounces. The greater proportion of the ores in this district are galena, carrying gray copper, and here the tetrahedrite is invariably highly argentiferous—in fact directly a miner finds it in his lode he is, as they express it, "eternally heeled."

Some few of the richest ores show proustite and stephanite in large quantities, notably the "Wheel of Fortune" and "Yankee Boy." As a class however, the ores are essentially smelting ores, but as yet we have no smelter nearer than Lake City, 37 miles by trail, or 110 by road, or at Silverton, 20 miles by trail, and it costs $45 per ton to pack to the former, and $20 to the latter place. There is every facility for a smelter here in the very centre of the mines, and a fortune to be made at it; splendid water power, 500 acres of pine timber, and more if wanted. But the right man has not come along yet.

With the close of the season of 1877, miners see a notable change in the San Juan region. It has grown solid. The day has passed when plucky, shiftless men, braving hunger, heat and cold, could come in here, find a claim, go out with a piece of the top-rock and sell the claim for a few hundred dollars. The prospector's reign is nearly over; prospect holes no longer find sale, and the only property men will look at is a developed mine. This is as it ought to be, and the best sign of coming real prosperity. It will clean out the horde of men calling themselves "miners," who have found good lodes, and who as long as they can by any artifice get a "grub-stake," sit at their cabin doors or round the bar-rooms of the nearest camp, with their pockets full of sample rock, waiting for the everlasting capitalist to come round the corner and buy them out at high figures.

There are easy fortunes to be made here in 1878, by three classes of men: First and foremost, by the smelter; and for the next ten years at least a smelt mill managed properly will make a moderate fortune each year.—There is no limit, you may say, to the possible output to ore in the San Juan country, and as soon as there is a market for the ores, the mines will be worked, of course. The smelter has, and will have for some time to come, a monopoly here; he gives the miner what he pleases for his ore and grows fat meanwhile; but it is the same story as with the building of toll-roads, the sure, safe and legitimate enterprise is thrown overboard for speculation. The man who comes in to build a mill, which he perhaps *does* understand, loses his head at the richness of the lodes and buys a mine which he does not understand, and waits for some one else to come and build the smelter to make it worth something.

Second:—The man of means who is a miner by profession, or experience, who will come here and look about him: He can get any amount of good silver lodes for a song,—and when I say "good silver lodes," I don't mean "prospect holes;" but mines that have been brought to a dividend

paying condition. The reader will naturally say, "if the mine pays a dividend, why will the owner sell?" Well, this is a conundrum that I for one am bound to give up. But it seems to me the ruling passion among San Juan miners. They who are fortunate enough to get possession of a lode that will produce pay ore from the first shot, or nearly so, immediately lay down their tools and go to work to try to sell it, apparently losing sight of the fact that the mine would probably be a large annual income to them for life, and to their children's children. There are, of course, many reasons for this. A majority of the present mine owners are the pioneers of the country; men to whom $10.000 is a fortune and all the money they want. Another reason is because of the multiplicity of partners in the best mines and consequent dissensions. Another, because they are too lazy to work. Another, because they are lunatics. I maintain that the man who owns a good lode here and sells it, is nothing else; but their name is legion who will do so gladly.

Third: Young men, miners of grit and muscle, who are not afraid of hard work, and are possessed of a few hundred dollars—say a thousand dollars each—they can come here and get a lode to work, either by finding one, buying one, or getting an interest given them in one for doing a certain amount of work on it. Five hundred dollars will put up a cabin and stock it with grub, powder and fuse for eight months. But they must be prepared to undergo toil and hardship, heat and cold, and be able to be their own builder, carpenter, stone mason, cook, washer-woman and tailor; all these as well as miner.

None others need apply. There are no book-keepers wanted; no clerks, no artisans; loafers are soon starved out; gamblers have none but their own kind to prey upon and an occasional "tender-foot;" and "kid gloved" gentry generally, *et hoc genus omne*, had better stay away. The San Juan *working* miners as a class are sober, hardworking men, and hospitable to a degree; pistols are never carried here, except by "tender-feet," whom you will generally see coming in with their loins girt about with no end of ordnance. Drunkenness in the mining camp I have never seen (except on the Fourth of July,)and, in fact, our miner is, unlike those in most other mining districts, "a solid man." If any of your readers would like any further information about this wonderfully rich mineral belt, I shall be glad to give it through the editor of this periodical.

IMOGENE BASIN, INTERIOR SNEFFELS' MINING DISTRICT, Nov. 25, 1877.

FOREIGN CORRESPONDENCE.

PARIS, December 2, 1877.

The belief that the moon exercises an influence on our atmosphere is as old as tradition itself. Astronomers of late appear to maintain the contrary. M. Faye, for example, a most eminent authority, asserts that the moon is innocent of all changes in the weather, despite the experience of peasants and sailors. Now, there is much to be said on both sides, and the subject is perhaps not quite exhausted, as we shall see. If the moon, observe the generality of people, exercise an influence on the tides, why not on atmospheric currents, equally as movable? Now, the moon can only act by its attraction or its heat; bodies attract in proportion to their masses, etc., so that the moon ought less influence a lighter body, such as air, than a heavier, like water. The influence of the moon at the equator does not raise the water of the ocean more than 39 inches. What we call the tide, that is, where the sea rises from 20 to 50 feet along the coast lines, is not due to the action of the sun and moon, but to the mass of water rolling in from the ocean, bathing the shores and penetrating into recesses, and which being unable to find an issue proportionate to its volume, becomes, as it were, heaped up; increases in height, for what is lost in breadth is gained in elevation. The barometer does not register any appreciable difference in atmospheric currents, due to the moon's influence; when this satellite passes over our heads it lightens bodies one ten millionth part of their weight. The moon's heat is insignificant; according to Piazzi Smyth, only equal to that of a candle at a distance of 40 feet. So much for theory. It is a general opinion, prejudice, if you please, that the moon has an influence on the production of rain. Shrewd observers say more rain falls during the second, than pending any other quarter of the moon, and when the latter's orbit is near, than when distant from the earth. Arago, contrary to what is believed, confirms the popular opinion within certain limits. The effects of the moon are general; the same day that it rains at Paris, it is beautiful weather at Orleans—yet our satellite is the same for both cities. There are no storms at Lima, and never at St. Helena, the other side of the Atlantic, is thunder heard; there are peals of thunder every day in the Moluccas and the Sonde islands, yet the moon in these regions passes through its phases as with us, and the ocean rises or falls, following the moon.

It is known that the tides of our atmosphere are insignificant; even so, are they capable of producing rain and fine weather? Clearly, there can be no rain without water, and no matter to what altitude the moon might draw up the atmosphere, not a drop of rain could fall if it did not already exist there. Bear in mind a volume of air can only contain a quantity of watery vapor proportionate to a given pressure and temperature. If the air expands by heat, or contracts by cold, the excess of vapor falls as rain. Currents of air coming from the ocean are charged with wa-

tery vapor, while currents arriving from overland are the contrary; that is to say, dry. The action of he moon seems to reside in the displacement of these currents. Where dry currents predominate there can be no rain, no more than water could be expected from a pump sunk in a parched soil. The sun in its annual course, in passing from one hemisphere of the heavens to the other, drags with it all our atmosphere, not only displacing it, but altering also its currents. Thus the trade winds that reign in each atmosphere around the equator approach our latitudes in summer, and recede in winter. These semi-annual perturbations are represented by the equinoctial winds. As a kind of central furnace, the sun's influence is considerable on all our atmosphere; it produces annually displacements in currents. Why not the moon also induce monthly changes, as it passes from one hemisphere into the other, causing aërial currents to penetrate different regions? Our satellite ought to force back the northern on the approach of the southern winds, substituting thus rain for fine weather. Such is likely the mechanism of our satellites on the weather; so that it is neither a prejudice nor exactly a popular error to hold that a change of moon will be followed by a changement of weather, and that the moon can equally induce rainy or dry weather, in two neighboring regions, as the latter are situated on the confines of humid or dry currents. It is thus explained why rain falls at Paris, while there is brilliant sunshine at Orleans.

In Paris hydrophobia is unpleasantly on the increase. Every year the government publishes returns of the number of persons bitten by mad dogs. Dr. Proust has examined all these statistics for the last thirty years, and has arrived at important conclusions. Thus: men are more frequently bitten than women, and children more than either. The latter is due to dogs being so often their playmates, and that children are constantly outside of doors, whether in towns or villages. But if attacked by mad dogs, children are more exempt from the consequences; of 154 individuals bitten between the ages of five and fifteen, only 37 died, whereas of 32 persons attacked, and aged between sixty-one and seventy, 22 succumbed. Dr. Proust also establishes that there are no "dog days," as the animals have no special season for the *rabies;* the maximum of registered bites took place, not in July, but in September and February; the minimum in March and August. Hence, the police regulations respecting dogs onght to be as active in winter as during summer. Cauterization, following the same authority, is the only known remedy against hydrophobia. Of 203 persons bitten, sixty per cent. died; when cauterization has been resorted to, or butter of antimony employed, immediately after being bitten, the death rate was only twenty per cent. It is difficult to have a red-hot iron, &c., ready at hand, so the doctor recommends tightly bandaging above the wound with a piece of cord, or a cravat, &c. This interrupts the circulation of the blood, and diminishes absorption—ordinarily very rapid, of the virus deposited in the flesh by the dog's teeth. The bleeding from the wound, by the well-tightened ligature,

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will be increased, and add to the chances of the virus being discharged; of course the burning is to be applied subsequently. M. Mennerson has employed electricity to calm the spasms in a young veterinary surgeon afflicted with hydrophobia, when chloroform failed to produce relief—in fact the anæsthetic only augmented the spasms; he applied the wires to the back of the neck and the soles of the feet; immediately tranquility ensued; the patient could eat, drink and talk; the sight of liquids did not agitate him. Unable, however, to support the continued action of the current, electricity was discontinued; the spasms returned, more violent than ever, and later, the heart suddenly stopped. Dr. Proust alleges instances where mad dogs had so little horror of water that they swam across rivers to attack sheep on the other side. M. Bourrel urges that the incisor teeth of dogs ought to be filed; thus blunted, they could not readily penetrate the flesh.

Dr. Delaunay has concluded a long series of experiments on the relative volume of heads. As a rule, he finds that persons possessing the largest heads are generally occupied in scientific pursuits. He has measured the heads of soldiers, officers, doctors, trades-people and workmen, and has obtained statistics from hatters to various colleges, and in a sense, furnishers to several classes of society. Dr. Delaunay concludes that engineers have larger heads than military officers; the latter more voluminous than privates. Religious persons are distinguished for their small heads; thus the inmates of St. Sulpice College, where the clergy are trained, are in this respect behind the Normal school, where university lay professors graduate. It is in the scholastic quarter of Paris, that hatters record the largest measurement of heads. Merchants would seem to come next, and then in order of rotation, tradesmen, the aristocracy, artisans, laborers, and rag pickers. Masons' heads are proverbial for their small volume. Also, the head, it is alleged, grows from intellectual exercise, perhaps as the muscles from work, and it is an observed fact, that peasants who immigrate from rural districts to cities undergo a gradual enlargement of the head.

The Academy of Sciences has since many years been occupied with the subject of localization of the brain. As many forms of paralysis correspond with lesions in the gray substance of the brain, and since the exact position of such substance can be localized, M. Baurdon recommends the operation of trepanning, thus laying bare the affected substance and treating it as a fatal abscess. He is also of the opinion that when some brain ailment disappears it is not in consequence of the lesion ceasing to exist, but to the white, replacing the functions of the gray matter of the brain.

The Messrs. Tissandier in their recent balloon ascension observed a few curious facts. The balloon rose in the afternoon, the weather being very beautiful; at the height of 440 yards there was a feeble current of air from east to west; at double this altitude there was moving in the same direction

a very violent current; at 250 yards higher the atmosphere was perfectly calm. This rapid stratum of air between two motionless layers is a rare circumstance. At the altitude of 1,200 yards the temperature was only 53° Fahrenheit, while the sun's rays were scorching. At 880 yards the atmosphere was full of "virgin's threads," which are only agglomerations of spider's threads, thus attesting how solar heat, or atmospheric movements, can whirl up light substances.

M. Breguet has brought the telephone, or speaking telegraph, under the notice of the Academy. The apparatus is simplicity itself—a small circular plate of thin metal, vibrating in presence of a magnetic bar; by means of a little bobbin of fine metallic thread, on the extremity of the bar, are communicated these currents of vibration to an identical apparatus situated at a distance more or less great. The French *savants* rather appeared to forget that the most extraordinary fact about the discovery is the value of the idea —that sound can be telegraphed distinctly, thus opening up a world of industrial applications. Hardly have the conducting powers of tubing being employed for speaking directly between two houses, or throughout vast buildings, when the *telegraphe parlant* is announced to supercede it. M. Breguet stated that not the least astonishing property of the marvelous new invention is, that of all telegraphs known, it functions under the influence of the most feeble currents. Further, he announced that after interlacing the sound in a resistance equal to a distance of 1,000 kilometres of ordinary telegraphic wire, he was able to hear phrases most distinctly, that is to say 625 miles. The apparatus collects, transmits and receives the sound of the voice. What a field is here opened for the imagination! Communications exchanged, irrespective of distance, with the living and personal character of voice, instead of the cold written representation of thought. The first metal disc indirectly produces the currents, and the latter develops, also indirectly, the vibrations in the second disc. It has been objected that the second plate in vibrating symmetrically, while emitting the same sound, does not produce the same volume. The currents are thus modified in their course. This may explain why the tone of the voice has failed to be "wired." Tone is but the superposition of a certain number of sounds upon a fundamental sound; a kind of very complicated mixture. The sound "received," as compared with that "dispatched," was alleged by some academicians, as a painted photograph of a painting to the painting itself. The results may be different when Mr. Bell conducts the experiments. The discovery with all its imperfections is not the less astonishing. What progress since the celebrated "ear" of Dionysius of Syracuse?

M. Rodier draws attention to the fact that submerged aquatic plants have the property of spontaneous movement. In June last he watched this rotation, which attained to 45 degrees. During the night the same plants turned in an inverse direction. M. Cornu has conducted some experiments

to show that in the case of inferior plants, the spores of ferns for example, it is to the influence of oxygen, that the putting in liberty of their reproductive bodies, is due.

M. Bechamp has devoted attention to the subject of musty eggs. He finds that hen eggs can be enclosed for twelve months in a vessel filled with infusoria, without the animalcules ever being able to pass through the shell; but the same is not true respecting the microscopic spores of must. M. Pasteur has shown that the elements of decomposition can exist in the egg itself, in consequence of foreign bodies being present in the ovary of the bird.

M. Westphal, a German doctor, applies the term *agoraphobia*—fear of public places, to the nervous malady some persons experience when they quit the foot-path to cross a busy roadway. Benedickt attributes the disease to confused visual sensations; Perroud and du Saulle, to the fear of a void or the dread of space, and that the arm of a passer-by, or following behind a vehicle, relieves. F. C.

GEOLOGY AND MINERALOGY.

MISSOURI IRON ORES OF THE CARBONIFEROUS AGE.

BY G. C. BROADHEAD, PLEASANT HILL, MO.

The various Iron Ores of Missouri have been extensively treated of in the Geological Reports of the State. Those of central and part of southeast Missouri in the volume of 1872. Others of southeast Missouri in the volume of 1874. But these reports have been mainly confined to ores occurring in the rocks older than the carboniferous. The ores heretofore worked in Missouri, belong either to the lower Silurian rocks or the Archæan; the exception is the opening of a few pits of Red Hematite in Callaway County.

Although our Carboniferous ores have been neglected, we nevertheless consider them by no means unimportant. To be sure, many of them are quite impure, but an advantage they possess over the other ores is, that they are easily mined and broken, and that many of them have sufficient limestone associated with them to render any other fluxes unnecessary. The ores in the older rocks are generally definite deposits, or as foreign developments in either regularly stratified or unstratified rocks. But the carboniferous deposits from regular geological strata, prevailed with the stratification of the associated rocks.

LOWER CARBONIFEROUS ORES.

These are found in large masses and good quality in Benton, Henry, Dade, Cedar, Green, Christian and Lawrence counties in Southwest Missouri, and may be referred to the age of the Ferruginous sandstone of the Missouri Geologists which is probably a member of the Chester group of Southern Illinois.

In Christian county, in S. E. S. E., Sec. 24, Tp. 27, R. 24, are found large masses of fibrous limonite. A shaft proved it to be over eight feet thick. In Sec. 19, Tp. 27, R. 23, are also large beds of the same kind of ore; also, in Sec. 7 of the same Township and Sec. 14 and 15, Tp. 27, R. 24. The lower caboniferous sandstones of Lawrence, Dade and Cedar counties are very ferruginous, and may prove to contain valuable deposits of iron ore. Dr. A. Schmidt, in Mo. Geol. Rept. 1872, speaks of iron ore banks in St. Clair and Henry counties that are undoubtedly referable to the sub-carboniferous age. The Brown bank in Sec. 23, Tp. 40, R. 24, in Henry county, on dividing ridge between Osage and Grand rivers. The ore is red, earthy hematite, partly changed into brown and yellow limonite, and associated with ferruginous sandstone.

The Collins bank in Sec. 23, Tp. 39, R. 25, St. Clair county, is an outcrop of red, earthy hematite. A very good deposit is, apparently the Marmaduke bank in Sec. 23, Tp. 39. R. 25, in St. Clair county. The ore is an earthy red hematite and a yellowish brown porous limonite. At many places in the Southern portion of Callaway county, are exposures of red hematite which appears to belong to the age of the sub-carboniferous. The following were the chief localities observed: Sec. 22, Tp. 45, R 10. Shaft hill in N. W. qr Sec. 4. Tp. 45, R. 10, has been worked, and the ore undoubtedly passes horizontally (or nearly so) through a hill of 800 feet diameter, the ore seam varying from one to five feet, is sometimes in regular layers, at other places in nodules or lenticular concretions. A section of the hill appears thus: From top:

1. Flint.
2. Red hematite.
3. Sandstone.
4. Conglomerate of Flint and Sandstone.
5. Sandstone.
6. Encrinital Limestone.

There is another on bank on Section N. Others also, three miles north of New Bloomfield on the Fulton road. In Sec. 42, Tp. 46, R. 10, there is also a fine outcrop of dense and fine grained red hematite. The ore here is two feet thick, dipping 20 deg. north.

Near Holt's Summit are similar outcrops of stratified red hematite.

Similar ore beds of sub-carboniferous age occur in Boone, Montgomery, Warren and Lincoln, some of them, forming good beds of red ochre, or as commonly called, "red keel."

The following are analysis of New Bloomfield ores:

	Compact Variety.	Earthy Variety.
Metallic Iron	63.87	61. 17.
Silica	5.80	8. 63.
Phosphoric Acid	0.10	0.165
Sulphur	0 017	0.018

UPPER CARBONIFEROUS ORES.

These ores exist in regular layers, interstratified with coal and shale beds, and lie chiefly in a horizontal position. They include three principal varieties: The impure carbonate or clay ironstone, the red hematites, and the limonites. They are more commonly found and in thicker layers in the lower coal measures.

CLAY IRONSTONE.

In the middle and upper coal measures, there are occasionally found thin bands of ore, but they do not often exceed two inches in thickness, and rarely are there as many as two layers found in near proximity. The lower measures often abound in bands and concretions of this ore, and although not often over two inches thick, yet are sometimes as much as four inches. We may also generally expect to find several layers within a few feet of vertical distance.

In Johnson county, on the banks of Clear Fork, five miles Southeast of Knob Noster were observed two layers of ironstone, each of one foot thickness and separated by one foot of clay shales; over the uppermost ironstone bed rested four feet of sandy shales inclosing concretions of ironstone, all amounting to three feet thickness of ore inclosed in seven feet of soft shales. Thirty feet below, there lies a bed of good coal, varying from two to three feet in thickness. Twenty feet above the ironstone beds, there rests another coal bed of one to one and a half feet thickness, with still another of one foot, lying twelve feet higher. Here are both coal and iron ore together—important facts for consideration. Similar ore beds and apparently a continuation of these, are exposed on Clear Fork about ten miles north. Between the two outcrops, and under Knob Noster and its vicinity, there lies a good bed of yellow ochre, varying in thickness from two to five feet.

On Grand River, near Little Compton, Carroll county, similar beds are exposed, lying horizontally, and separated by soft clay shales. The ironstone beds are here included within a vertical thickness of thirteen feet of clay shales, and amount in all, to over two feet in thickness. A one and a half foot seam occurs in the bluffs above. Three miles east of Clinton, Henry county, the shale beds contain concretionary forms of ironstone in large masses. Similar ore, quite fossiliferous, seems quite abundant at Gilkerson's ford on Grand River. Two good coal beds also lie in the same bluffs. We predict that at some future time, this locality will become important. Other important localities are at Timbered Mound and on Marmaton

north of Nevada, Vernon county, the western part of Cedar county, on Panther Creek, Bates county, near Rockville, and on the same creek a few miles north.

In the northwest corner of Jasper there appears a two inch band of poor quality of clay ironstone, which contains much iron pyrites. The owner thereof confidently believed the rock to contain silver and had commenced the construction of works to reduce the ore. He was not inclined to accept our advice against such foolish expenditure of time and labor.

All of the above coal measure ores are impure carbonates, and will yield from 30 to 40 per cent. of metallic iron. An ochreous crust is often found on the exposed surface. The layers are often jointed, the joints lined with calcite and sometimes with a thin plate of pyrite or zinc blend.

RED HEMATITES.

These occur either as open porous ores, as ochres, or as hard, close grained ores.

In Linn, Sullivan and Adair counties there occurs from ten to fifteen feet of red shales, soft and smooth feeling, which in many places include nodules of hard close-grained ore, varying in size from quite small to pieces three or four inches in length and two inches thick; their prevailing shape being roundish elongated. A fracture often exposes minute seams of carbonate of lime, which, especially partly compose the remains of fossils, of which a few well recognized coal measures species were observed, including *Discina nitida* and *Myalina Swallowvii.* Near Linneus, and also on Locust creek and Spring creek, three miles southeast of Laclede these nodules are quite abundant. On Locust creek and Spring creek, Sullivan county, and at many places in Adair, also in the eastern part of Linn, these red shales prevail and are quite ferruginous and would undoubtedly form a good paint, yet the ore nodules are small and not so abundant. An analysis of a nodule from Garretts, near Linneus, by Mr. Chauvenet, gave sixty-two per cent. of metallic iron. Near Calhoun, in Henry county, red hematite occurs as a porous ore of apparently good quality, and soft enough to be easily crushed. The bed is about five feet thick, and underlies nearly ten acres of ground. It is overlaid by a few feet of loose nodules of kidney ore dispersed through the shales.

We also find, both at Clinton and Calhoun, Henry county, a six inch band of red hematite, quite fossiliferous. The evidence is, that this ore has been altered from a limestone nucleus with a ferruginous crust of red and brown ochre. At Calhoun, the interior is of an ash drab, next a half inch red band, then a half to three quarter inch of alternations of red and brown with brown exterior. At Clinton, it is deep red throughout. The fossils contained are typical of coal measures, and are: *Productus Mervicatus, Pr. prattenianus, Hemipronites crassus, Chonetes mesoloba. Ch. Verneuilliana, Spirifer planconvexus,* and *Discina.*

LIMONITES.

The Limonites are either hard or soft, brown or yellowish. The Knob

Noster bed previously spoken of, was traced for several miles, and found to underlie not less than five square miles. It varies from a lean, yellow ochre to a richer, and was also found as a firm, hardened limonite of good quality. Further examinations showed it to be originally a ferruginous fire-clay, containing the well known *stigmaria ficoides*. Four feet above it lies a 16-inch coal bed.

Beds of limonite are of common occurrence in the eastern part of Vernon, and are also found at many places in Barton. Ochrey and concretionary beds overlie a certain coal near Calhoun, Henry county. But the best exposure was observed in the southwest part of Cedar county, where are two beds of good limonite ore, one bed of red ochre and a bed of coal, all occurring in the same section thus:

1.—Hilltop and slope.
2.—28 feet of sandstone.
3.—5 feet of porous limonite.
4.—1½ feet of soft, reddish brown limonite, with coal plants.
5.—7 inches of ochre.
6.—4 inches of red sandy shale.
7.—1 foot of sandstone.
8.—6 inches of coal.

No. 3 of this section, according to Mr. Chauvenet, yielded fifty-seven per cent. metallic iron; No. 4 yielded fifty-four and eighty one-hundredths per cent. These ores occur in regular horizontal layers, extending into the hill, and do certainly underlie much of the neighboring country, and being soft are easy to take out. Besides the six inch coal seam there are other thicker beds in the vicinity.

If we compare the analyses of these ores with similar ones of Indiana, Pennsylvania or Ohio, we find ours are equally as good, and while the main working ores of those States will not average over 35 per cent. of metallic iron, and some are worked that contain less than 30 per cent., and but few reach as high as 45.

A clay iron stone from Barton county, Mo., yielded 33 per cent.; another 44; our brown hematites 53 and 58, and red hematites have even yielded as high as 62 per cent. of metallic iron. We have many bands of ore that will yield from 25 to 35 per cent., and there are many other thin strata that I have not mentioned in this article.

FOSSIL LEAVES IN KANSAS.

The Kansas Academy of Science at its late meeting adopted the following resolution:

Resolved, That a committee to be composed of three members of this body be appointed, whose duty it shall be to promote, by all proper means, a diffusion of a knowledge of the facts of elementary science in respect to their application to the affairs of common life; and to encourage among the

people the investigation, especially, of matters pertaining to Kansas.

Prof. Mudge, as a member of the committee, has prepared the following paper relating to Kansas geology:

"There is a deposit of red sandstone in Kansas, extending from Republic county on the north line of the State, to Reno county in the Arkansas valley, which contains most interesting fossil leaves. This rock deposit is more recent in the order of construction of our earth's crust, than Hugh Miller's Red Sandstone. It is of the lowest cretaceous age, having been deposited just above our Kansas upper carboniferous rocks. Many of the leaves in this sandstone are very distinct, showing even the finest veins and markings. Among them are found the oak, willow, hickory, poplar, beech, sassafras, maple, birch, laurel, plum and apple, besides many small shrubs. In addition we find the palm, fig, cinnamon and magnolia, now so common in in warmer countries. Occasionally we discover in the same sandstone salt water shells.

The occurrence of tropical plants, is explained by the facts which show that the vegetation grew on islands in the middle of the ocean, which contained warm currents, like the present Gulf Stream, which kept a mild land temperature. It is also probable that the palm, fig, and cinnamon were hardy species of their kind, which would withstand a little more cold than those now living.

The most instructive feature of those fossil leaves to the geologist is, that they are the first plants of the high family of dicotyledons, or plants with net veined leaves and with an annual ring of growth on the trunk. They embrace all the common forest and fruit trees of the temperate zones excepting the pines and other evergreens. Botanists class them as the only trees of high rank, having true flowers and fruit.

Previously to this time, in all the older deposits, no plants of higher organization can be found, though careful search has been been made by geologists in all parts of the world. Pines, which are classified near the middle rank, have been long known as three times as old, geologically considered. Ferns and many other flowerless plants are found, but not as old as the pines. The first palms, though considered in the lowest rank of trees, came in with our net-veined leaves of Kansas, the two extremes of tree vegetation appearing here at the same age of the world. The palms are placed by botanists as the lowest trees, far below the pines.

About one hundred of the net-veined leaves have been found in Kansas and Nebraska. The total thickness of the deposit containing them is less than 500 feet.

Here is something for the Darwinists to consider. All these varied and modern trees are found coming into existence suddenly, with all the various types which grow in our forests to-day. No trace of any grade from which they could have been derived can be discovered, though carefully sought, both here and in other parts of the world. According to Darwin, the low vegetation should have appeared first, and gradually merged into

the highest type, and the latter seen only in the most recent deposits. But these from the lowest part of the Cretaceous are almost identical with those now living and some entirely so.

ARCHÆOLOGY.

EPHESUS, CYPRUS, AND MYCENÆ.*

BY BAYARD TAYLOR.

Side by side with the splendid achievements in physical science which distinguish our generation, must be placed the results of archæological research. The two forms of labor are not necessarily connected or independent, yet they have been equally stimulated by a common experience in detecting possibilities of entrance—often slight and inconspicuous posterns, discoverable rather to the eye of faith than to that of knowledge—in barriers which once seemed hopelessly closed. It is not so very long since the complete or at least formless ruin of the great cities and edifices of antiquity was a generally-accepted belief: the phrase "not one stone shall be left upon another" was supposed to express a literal fact; the lost languages were given up as lost; and the unrecorded histories were never meant to be restored. Now scarcely a year passes without the discovery of some important historical landmark, and every new light of knowledge, illuminating the remote past of our race, reveals the dim outlines of a still remoter past behind it. As one climbing a long mountain-slope, we see farther backward in proportion as we rise.

The great age of archæological discovery began with Layard's excavations on the site of Nineveh, and the researches of Sir Charles Fellowes in Caria and Lycia. Soon afterward M. Mariette, carrying a similar faith and enthusiasm to Egypt, found Memphis, and entered upon that long series of successes which has not yet come to an end. The race of explorers immediately begat a race of scholars: new Egyptologists appeared, and enforced their claims to honor and authority; Assyriologists for the first time came into being; and George Smith found history and religion on the dumb tablets exhumed by Layard. His own later researches at Nineveh; the excavations on the Palatine Hill, in Rome; Mariette's discovery of the statues of the Shepherd kings at Tanis; Schliemann in the Troad and at Mycenæ; Wood at Ephesus; Cesnola in Cyprus; and Curtius at Olympia—to say nothing of such minor research as that of the Austrian Government at

* We give the following extracts from a very interesting article in the last *North American Review*, upon the labors of Wood at Ephesus, Cesnola in Cyprus, and Schliemann at Mycenæ, by the distinguished traveler and author, Bayard Taylor, in order that our readers may have the benefit of his opinion of the value of the theories put forth by these enthusiastic discoverers; especially those of the last two, from whose letters and reports we have quoted so freely within the past year.—[ED.

Samothrace, Davis at Carthage, and Burton in the land of Midian—constitute a body of discovery of such vast importance and absorbing interest, that the civilized world seems scarcely yet fully to credit its possession. It is a skeptical age, and, when it sees so many men, who at first sight appear to be guided only by an intense, unreasoning belief in their object, actually finding what they sought, the natural tendency is to doubt and question and seek for antagonistic views. All the precious material so recently acquired must first be classified and relegated to its proper place in our ordered knowledge of the human past, before the world shall clearly recognize its importance. Its influence on the class of intelligent thinkers is already very perceptible.

Almost every one of the great discoveries I have enumerated has been due to faith in the trustworthiness of the ancient authorities. Since Herodotus and Ptolemy, so long suspected of having been fabulists, have been wholly rehabilitated as careful and conscientious guides, Strabo, Pliny, Pausanias—indeed all descriptive passages of classic authors—receive an authentic stamp, which they scarcely possessed before. But the belief, which instigated such labors and trials of patience as every explorer must undergo, was not a mere uninstructed enthusiasm. Mr. Wood believed that there had been a Temple of Diana at Ephesus, and hence that its remains were not past finding out; General di Cesnola believed that there had been stately temples at Idalium, Golgos, Amathus, and Paphos; and Dr. Schliemann, in turning to prehistoric Mycenæ, depended far more upon the statement of Pausanias than upon the strophes of Æschylus. Although in the story of each there may seem to be an element of lucky accident, it will prove to be hardly more than the luck which, in the end, rewards persistent enthusiasm. There was a point in the labors of each when a doubting explorer would have stopped short, discouraged; and the triumph lay beyond that point. The narratives of the three last-named archæologists have appeared during the past year, and they form, in conjunction with Dr. Hirschfeld's report on the explorations at Olympia, such a contribution of recovered knowledge as should make the year forever memorable.

Beginning with Mr. Wood's first excavations at Ephesus, in 1863, and closing with Dr. Schliemann's discovery of the royal tombs at Mycenæ in November, 1876, the labors of the three gentlemen are included within a period of thirteen years. Their tasks were wholly distinct in character, and their methods of labor, therefore, had but a general resemblance. Mr. Wood's was the simplest, his one aim being to discover the Temple of Diana, the situation of which was indicated by nothing upon the present surface of the soil. Dr. Schliemann's was the easiest, since his explorations were fixed within circumscribed and rather contracted limits; and General di Cesnola's was, at the same time, the most arduous, and the most uncertain in its probable results.

I shall take the three in the order of their labors, and endeavor to detach, in each case, the clear and simple story from the somewhat irregu-

lar mixture of personal narrative, description of objects, and antiquarian conjectures, which we find in the volumes. By adding thereto a statement of results, with impartial reference to the character of the objects discovered, I may be able to furnish the reader with the necessary basis of fact, and qualify him to examine, with some degree of independence, the conflicting theories which seek to establish themselves thereon. The spoils of Cyprus and Mycenæ, as will be seen, are too new and unexpected to be readily disposed of, even by the most experienced scholars. In order to make room for them, the old adjustment of epochs in the art and general culture of the ancients must be materially changed; and the archæologists are almost as unwilling to accept such changes as are the theologians. Least of all, have they the right to disparage the enthusiasm of the explorer, over-credulous though it be; for to that enthusiasm they owe the achievements recorded in these three works. There are not many book-scholars who would have labored at Ephesus for years before grasping the clew which led Mr. Wood to the Temple of Diana: still fewer would have dreamed of digging at Mycenæ, with the expectation of finding anything beyond the foundations of Cyclopean walls; and in 1862, more than three years before General di Cesnola reached Cyprus, the French archæologist, Count de Vogué, makes this report of his researches: "Quant à l'exploration extérieure de l'île, je puis le dire, elle a été aussi complète que possible; *rien d'apparent n'a été omis.*" It is, perhaps, not in human nature that a man of distinguished learning shall find that a favorite theory, upon which he has lavished years of thought, is jarred and in danger of being overthrown, without jealously defending it; yet it is curious to notice what immediate receptance any discovery obtains which seems to establish a point in what is called sacred history, and how much doubt and discussion follow the evidences of a fact underlying some episode of the semi-mythical age of profane history. * * * * * * * * * *

No theory has been changed, nor any new question raised, by Mr. Wood's success. He has worked upon purely historical ground, and the ancient authorities are his best witnesses. No one has disputed the solid marble evidence which he has brought to light; and the main lesson to be drawn from his labor is that complete destruction is a more difficult task than has heretofore been supposed—that the simple processes of Nature almost invariably hide some fragment of that which war or fanaticism would annihilate, and protect it for the believing explorer who may come two or three thousand years afterward. The only possible contribution to a more ancient period of art, which Mr. Wood may have furnished, is found in some fragments of sculpture, which Mr. Newton considers archaic, excavated near the lowest step of the temple. Their resemblance to some of the objects found by General di Cesnola in Cyprus is noticed by the distinguished archæologist, but a more careful examination and comparison are necessary before their character can be approximately determined.

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It is difficult to assign an exact place, either in history or art, to Cesnola's discoveries. He uses the general term "Cypriote" to designate them, in contradistinction to the Egyptian, Assyrian, and archaic Grecian elements which are combined in so many of the objects: this term must suffice until scholars are able to separate, or at least classify, the latter, and determine something in regard to their historical precedence. Already Mr. Newton and Mr. A. S. Murray appear to diverge somewhat in their estimates of the age of the pottery, while both are disinclined to attach much weight to the far greater antiquity of the fictile art in Egypt and Assyria. Every advance into the prehistoric past awakes a natural, perhaps unconscious tendency, both to shorten the successive periods of civilization and to attach a certain symbolism of faith to forms which may have descended into mere conventional use. Yet the position of Cyprus, visible from the shores of Syria (Phœnicia) and Cilicia, must have led to its settlement many centuries before it was conquered by Thothmes III. about 1600 B. C. This is the first historic mention of the island, and if one of the statues found at Golgos should prove to be, as is surmised, that of the Egyptian king, it cannot reasonably be ascribed to a later period. Greek immigration, subjection to Phœnicia, Assyria, Persia, and again to Egypt, succeeded during the next thousand years, leaving those mingled traces which make the Cesnola collection, in this particular, the most remarkable in the world. A very curious circumstance, and one which may throw some light on the simultaneous use of emblems belonging to several different faiths, is the separation of the many statues of Golgos into groups, according to their nationality. It is almost the only instance, in archæology, where the latter rule has not sought to destroy or mutilate the tokens of the earlier.

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Since the publication of Dr. Schliemann's work, I have re-examined the greater portion of the objects in the Cesnola collection, in the Metropolitan Museum; and I have been surprised to find so many of them identical with those found by Schliemann at Mycenæ. The diadems of gold-leaf, the wreaths of laurel-leaves, the golden buttons (some of them showing exactly the same ornamental patterns, in *repoussé* work), the bronze hatchets and sword-blades, are not to be distinguished from the same objects among the Mycenæan spoils; while there is scarcely a type of pottery, or a form of the rude terra-cotta idols, contained in the latter, which is not matched by something from Idalium, Golgos, or Curium. When we add thereto the similar objects from what Schliemann styles the pre-Trojan city at Hissarlik, and the Rhodian vases from Ialysus, we find ourselves face to face with one and the same school of ceramic and decorative art. The inference which might be drawn from this fact seems to conflict with former historical theories. Certainly the same race could not have possessed these separated shores and islands at the same time, nor could one divinity (however related, as we know, were the ancient theologies) have received the same honor in each place. We are thus led to accept the

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existence of conventional forms and decorative patterns in art, and to trace them to what was undoubtedly their primal source—Egypt and Assyria. Here another question arises, which the professional archæologists do not seem to have adequately considered. At what phase of human civilization does the fictile art make its appearance? From the evidence of our ancient mounds in this country, it is the first step from barbarism to the beginning of civilization, and thus almost the oldest of the rude mechanic arts. Hence, in Phœnicia, its introduction must have speedily followed its invention in Egypt, which was nearer 4000 B. C. than 3000 B. C., while in Assyria its antiquity can hardly be ascribed to a later than the latter date. How long would the neighboring island of Cyprus remain ignorant of so useful an art? and how much more time would be required to carry it to Rhodes, the Peloponnesus and the Troad? Evidently, the age granted by certain scholars to the oldest specimens of Cypriote pottery—about 800 B. C.—and that allowed to the relics from Mycenæ, two or three centuries earlier, does not indicate, even if correct, the period when the art was first brought into practice, in either locality. The term "prehistoric" must not be understood, therefore, simply as designating that cruder form of civilization which has not yet learned to preserve and transmit its records to the succeeding generations. It indicates, at best, in the Hellenic past, the ages of which the exact records have been lost, when no era had been fixed for the computation of years, and, as a natural consequence, the primitive mythical history had become confounded with later historical facts.

Dr. Schliemann's discovery at Mycenæ has the advantage of whatever probability belongs to this view. All our recent explorations of the past of the human race, all the amazing discoveries of the last thirty years, establish more firmly the fact that a basis of actual historic truth underlies every feature of ancient history which we have been accustomed to consider mythical. The opposite views which prevail, it is evident, arise chiefly from the reluctance of scholars to accept any inference which may conflict with the Hebrew chronology. Forgetting that far older and mightier empires, with far earlier records, existed on both sides of Palestine, and left their stamp on its political and hierarchical organization, even on its supreme faith, they waste much labor in constructing defensive theories, instead of reasoning backward from independent evidence. It is simply impossible that two such powers as Egypt and Assyria should have existed, without stimulating all the neighboring races which possessed the least capacity for development. We do not find such phenomena in the world now, and there is no reason for believing that they ever occurred. Speaking as a layman, without the shadow of a claim to authority, I find it exceedingly difficult to believe that in the time of Homer, when Egypt had possessed a written language for at least two thousand years, the Greeks, with the development in art and political organization which they then enjoyed, should not have had some form of alphabet. It is equally difficult to believe that the *rhapsodes* transmitted the "Iliad," orally, for centuries

without falling from its even heroic strain to meet the comprehension of promiscuous assemblages of hearers. Either the Greeks were stubborn barbarians at the epoch of the Trojan war, or they gave no token, then, of the inventive and independent genius which, a few centuries afterward, made them an immortal, an almost ideal race, for all succeeding ages.

But if, on the one hand, the accepted views in regard to the scope and character of the early Hellenic culture may be false, on the other hand these recent explorations suggest, even to the most skeptical, the truth underlying the heroic myths. Whether or not Hissarlik be the site of Troy, it is at least that of a prehistoric city, which was destroyed by fire. The coincidence of the art, and especially the mortuary ornaments and modes of sepulture, discovered at Mycenæ and in Cyprus, may or may not prove that the same race at one time inhabited both: the diadems and laurel-crowns may be no indication of royal rank; but the location of the tombs in the Agora is a certain evidence of the distinction in which the dead were held, and at least five of the latter must have been buried at the same time. We have thus the fact of slaughter, or war, followed by posthumous honor, and transmitted in the tradition of Agamemnon repeated by Pausanias. Dr. Schliemann's discoveries do not turn Æschylus into history, but they furnish a remote historic basis for the tragedy. In Cyprus, the bracelets of King Etevander and the inscription on the Assyrian cylinder establish each other's veracity, even as the record of Sennacherib at Nineveh and the Hebrew statement of the tribute paid by King Hezekiah. The human brain is not skilled in the art of inventing history without material. Some of the most monstrous legends have been finally traced to an intelligible origin; and it is scarcely possible that the large frame of geographical and ethnological truth, inclosed by the "Iliad," should have been peopled by merely imaginary figures, and made the scene of imaginary deeds.

DISCOVERIES AT OLYMPIA.

According to the instructions received from the directing committee at Berlin, the first aim of the operations conducted this year by the new chief of the German expedition at Olympia, Dr. George Treu, has been to continue and complete the clearance of the ground already excavated in front of either end of the Temple of Zeus. Rich successes have already rewarded those renewed labors. On the eastern side, the demolition of the walls of the Byzantine settlement has yielded a large number of fragments, but most of them small, and among them only one which could be immediately identified as belonging to the sculptors of the pediment group; this was a part of the helmet of Oenomaus.

Another wall, however, in the same neighborhood, but further north, starting from the second column of the east front of the Heraeum, and com-

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posed of indiscriminate fragments of columns and figures, has yielded three draped statues of the Roman period, all found within a distance of twenty feet. These are complete but for the heads; two of them are female figures, and bear the names of Athenian workmen—Eros and Aulos Sertous Eraton—these were found on October 29. The third, a male figure, only came to light on November 14th, and, at the time of our advices, was not sufficiently extricated to make it certain whether it bore an inscription or not.

But by far the most important of the discoveries has been made in the diggings to the west of the temple. These, taking them in chronological order, have been as follows: On October 19th the middle portion of one of the groups of Centaurs and Lapith women from the pediment of Alkamenes; this fits with two other splendid fragments found last season, and gives us the group almost complete. The Centaur has grasped the Lapith maiden with his left arm, and thrown both his fore legs about her; she has seized the ravisher by the beard, and strives hard to force his drunken head away from her. It is remarkable that while the upper portion of the group was found in the most northerly situation of all last season's discoveries, the new portion lay more than fifty yards off, at a distance of about thirty yards west and southwest of the southwest angle of the temple.

On October 23 there followed a still more fortunate find—that of the whole body, wanting only the right arm and legs below the knee, of the beautiful somewhat archaic Apollo, who occupied the middle place of the pediment among the combatants, and whose head only had been found last year. On October 26 there came to light the head of a Centaur, somewhat injured, but full of character and of great interest, because it serves to complete the group corresponding to that last described, which had its place next to the Apollo on the other side, and which is supposed to represent the bride Deldamia and her assailant. Several holes round the head of the Centaur show that he is represented as wearing a reveller's garland, probably of bronze. A few more hands and feet are all the additional finds that belong to the pediment sculptures.

But on October 23 an important piece of another kind was discovered in the shape of an archaic bronze head, about six inches high, intact, wearing beard and mustache, and having the hair treated in long plaited locks on the shoulders, and two rows of conventional ringlets over the forehead. Lastly, and to the student of archæology perhaps most interesting of all, a large bronze plate measuring eighty-five centimeters at the top and twenty-six at the bottom.

This unique specimen of art is wrought with four rows of figures in relief, in an extremely archaic style corresponding to that of the earliest so-called Corinthian vases, and, as we may infer from the description of Pausanias, to that of the chest of Cypselos. In the lowest compartment appears a four-winged female figure, who in either hand holds up a lion by the foot; in the second, Herakles, as a kneeling archer, shooting a flying Centaur, and without his later attributes of the lion's hide any club; in the third

compartment upward, two griffins facing one another, and in the uppermost compartment two eagles. It can not be doubted that this, the first discovery of its kind made at Olympia, is destined to furnish an invaluable link in the study—for which the materials are only now beginning to be collected and compared—of the origins of the Greek art.—*Academy.*

ASTRONOMY.

SUN SPOTS AND THEIR EFFECTS.

The phenomena of sun spots are now familiar: multitudes of people have seen them, and everybody has read about them. It is well known that the surface of the sun is not that uniform disk of light that it was formerly supposed to be, but abounds in gulfs, dark chasms, up-rushing streams of flaming gases, and lurid prominences, sometimes 100,000 miles high. But these striking effects are not uniform: the sea of solar fire like our two oceans, is sometimes violently agitated and sometimes quiet. The spots are variable, being now many and enormous in size, and again few and small. This periodicity, moreover, is proved to be regular. Prof. Schwabe, of Dessau, discovered that, instead of being uniform in number and intensity from year to year, spots increase and decline at definite rates for a term of years. As a result of 9,000 observations, during which he discovered 4,700 groups, he traced three complete oscillations from maximum to minimum, which he estimated to take place in about ten years. Prof. Wolf, of Zurich, went into an exhaustive history of the subject, and by collating a vast number of observations and records from 1750 to 1860, he verified Schwabe's general results, but showed that the period of oscillation is about eleven years. His data, scattered through a course of 140 years, comprehended observations in the seventeenth century made on 2,113 days; in the eighteenth century, on 5,500 days; and in the nineteenth century, on 14,860, or a total of 22,463 days. On this broad basis of observation, made with no reference to any hypothesis of variation, it is established that the solar energy changes in intensity by a regular law of rise and fall from a maximum to a minimum of effect; and that the maximum, or greatest activity, coincides with the period of violent perturbation when there is the greatest number of eruptions of heated matter from below, and the most conspicuous display of sun-spots and prominences; while at the minimum periods these manifestations are greatly reduced, or almost entirely wanting.

It is now an admitted fact of science that the earth is dependent upon the sun for the chief portion of the energy by which terrestrial effects are produced. With the exception of the ebb and flow of the tides, all the forms

of earthly power are recognized as having, directly or indirectly, a solar origin. Wind-power, water-power, steam-power, the activities of organic growth, all animal energy, and the great phenomena of changes in the crust of the globe, due to the circulation of waters through the circulation of atmospheric agency, are caused by the forces of solar radiation. But if the solar energy is variable, the question naturally arises, "Is that variation manifested in terrestrial effects, and, if so, in what manner, and to what extent?" The subject is vast and new, but the indomitable energy of modern scientific inquiry has rapidly accumulated evidence which answers the first question in the affirmative, and gives instructive replies to the others. The sun-spots, for thousand of years unknown, and for centuries after they were known regarded as mere matters of curious and idle speculation, are now linked indissolubly to the whole scheme of activity which we observe upon earth, and of which we are ourselves a part. Even the famines by which nations are periodically desolated seem to be connected with this intermittence of solar energy. The evidence upon the subject has been summed up in an able and impressive paper contributed by Messrs. Lockyer and Hunter to *The Nineteenth Century*, and which will be found in full in No. VIII. of *The Popular Science Supplement*. We can here do little more than indicate the remarkable connections that have been disclosed between the variations of solar activity and resulting terrestrial phenomena.

1. The first coincidence was in the field of terrestrial magnetism. "A freely-suspended magnet, although it points in one direction, is neverthless within small limits, always in motion. Certain of these motions depend, as is well known, upon the hour of the day; but the magnet is also liable to irregular, abrupt fluctuations, which cannot be connected with the diurnal oscillations. While Hofarth Schwabe was engaged in delineating the sun-spots, Sir Edward Sabine was conducting a series of observations with regard to these spasmodic affections of the needle, and he found that such fluctuations are most frequent in years of high sun-spot activity." Nearly a hundred years ago, Van Swinden had suggested a periodicity in these irregular magnetic movements. Gauss, Arago, Lamont, and Gautier, pursued the research, and established the existence of a cycle of magnetic variation having an eleven year period, the maxima and minima agreeing with the maxima and minima of sun-spot activity. Schiaparelli and Broun have confirmed these results, and the latter observer concludes that, while the sun-spot activity is not an exact measure of magnetic action, "each is a distinct result due to the same cause." This disturbance is so great that, in years of maximum sun-spots, the working of the telegraph has been powerfully interfered with.

2. Connected with these effects there have been observed corresponding disturbances of electrical activity. A magnetic storm never rages without various accompanying signs of electrical excitement. These are seen in auroral displays that in their varying intensities conform to the magnetic cycles. Prof. Loomis, of Yale College, after a critical study of the subject,

"concluded that the auroras observed in Europe and America exhibit a true periodicity closely following the magnetic periods, but not perfectly identical with them;" and Mr. Charles V. Walker, telegraphic superintendent holds as an established fact that "earth currents, disturbed magnetometers, and aurora, are parts of the same phenomenon."

3. There is evidence of thermometric variations, or fluctuations of temperature, in periods coinciding with the sun-spot cycles. The observations in this case are, however, much complicated and obscured by the agency of the atmosphere, which acts as a screen upon the earth's surface, disturbing the radiations that would affect our thermometers. But a large number of observers, among whom are Baxendell, Blandford, Stewart, Roscoe, Piazzi Smythe, Stone and Koppen, have accumulated numerous observations both in the temperate zones and in the tropics, showing that "the calorific intensity of the sun's rays is subject to periodical changes, the maxima and minima of which correspond respectively with those of sun-spot frequency.'

4. The wind-disturbances of the earth's atmosphere follow the same law; there being a coincidence between the frequency of cyclones and sun-spots. Observations on other sides of the world, and in the tropics where the wind disturbances are most violent, lead to the conclusion, as stated by Mr. Meldrum, that "the whole question of cyclones is a question of solar activity; and that, if we write down in one column the number of cyclones in any given year, there will be a strict relation between them—many sun-spots, many hurricanes; few sun-spots, few hurricanes."

5. Confirmatory evidence of this is found in the records of shipping-disasters. From the returns of marine casualties posted on Lloyd's loss book it was found that they disclose "a cycle closely corresponding with the sun-spot period. The percentage of casualties on the registered vessels of the United Kingdom (Great Britain) was 17½ per cent. greater during the maximum two years in the common cycle than during the minimum two years."

6. It has been further shown by the observations of Baxendell, Meldrum, Rawson, Jelinck, Wex, Dawson, Hennessey, Broun, and Brockelsby, that there is a fluctuation in the fall of rain in which the same law may be traced; that is, "a connection between the variations of the sun-spot area and the annual rainfall; the rainfall rising above the mean when the sun-spot area is in excess, and falling below the mean when in periods of small sun-spots." The monsoons are the great sources of rain-supply at Madras, in India. The rainfall cycle has been traced out in that country, and the deficiency and excess of rain connected with the great solar periodicities. The writers whom we are following say, for example, that the "water-supply brought to Madras by the southern monsoon is 26½ per cent. greater in ordinary years than in the years of minimum sun-spots." And, again, "there is a rain-cycle of eleven years at Madras which coincides with the cycle of sun-spots; the periods of maxima and minima in these two cycles disclosing a remarkable coincidence."

7. The variation in the rainfall of India involves the food-supply of that country, and is a question of famine and starvation. Observations on the variations of water-supply, in India, of course go no further back than the introduction of rain-gauges. Commencing the inquiry in the year 1810, Messrs. Lockyer and Hunter say: "The years of famine in Madras since that date have been 1811, 1824, 1833, 1854, 1866 and 1877. These famines were caused by deficient rainfall in the preceding years, namely, 1810, 1823, 1832, 1853, 1865, and 1876. Now, five out of these six years of drought fell within the three years' group of minimum rainfall and sun-spots (shown in the foregoing tables) the remaining drought (1853—'55) extended over a year immediately preceding the minimum group, and two years within that group; the famine itself resulting within the minimum group. Three of the six years of drought fell exactly in years of minimum sun-spots; one fell in the year preceding a year of minimum sun-spots; one fell in the second year preceding the a year of minimum sun-spots the remaining drought, 1853—'55, fell in the first, second and third years preceding a year of minimum sun-spots. . . . No famine in Madras has been recorded from 1810 to 1877 caused by a drought lying entirely outside the minimum group of sun-spots and rainfall."

We have here been able only to hint at the points made in the paper referred to. The case is strong, in fact much of it demonstrative, yet it is, of course, most incomplete. Though important practical conclusions have been reached, the investigation is in its crude, preliminary stage, where the truth is caught vaguely and by glimpses rather than seen clearly and by a steady gaze. Yet it is a magnificent research, with already-assured results and a splendid promise. We commend the subject to the consideration of those who hold that science, to be genuine, must have become exact, certain and perfect.—*Popular Science Monthly.*

THE METEORS OF OCTOBER 1-20, 1877.

W. F. DENNING, F. R. A. S.

Here in England the weather was much clearer than usual during the month of October. Between the 1st and 20th, I made a series of observations of shooting-stars, and succeeded in noting 522 of them during the 43½ hours I was enabled to look at the sky. In the mornings 338 were seen in 22¼ hours, and in the evenings 184 were seen in 21¼ hours. Thus the rate of frequency in the mornings greatly exceeded that recorded in the evenings, the calculated horary numbers for one observer (after making certain allowances for time spent in registering the paths) 20.3 being and 10.1 respectively, and for the whole of the night, 15.0. This is rather in excess of the usual figures, and the horary number a. m. as compared with that p. m is also in excess, and readily accounted for by the fact that the chief October shower called the *Orionids* is not favorably visible until after midnight.

Of the total number (522) seen, I carefully registered the apparent paths and other details of 429, their estimated magnitudes being as follows:—

}1st, 10	=3rd, 100
=1st, 22	=4th, 144
=2nd, 83	5th and below, 70

In the early part of the month, I looked toward the northeast sky, and after the 7th either towards the northeast or southeast. My observations prove that meteors were unusually abundant between Oct. 1-20, and I calculate that during the twenty days over which they extended, no less than 57,600 shooting-stars brighter than or as bright as 5th magnitude stars entered the earth's atmosphere (night and day, and both hemispheres included) Large as this number appears, it will be readily conceded that it closely approximates the truth. I have already mentioned that the horary number was 15 for the sphere of vision of one observer. Now, one pair of eyes certainly cannot command more than one quarter of the visible heavens, therefore we must adopt 60 as the hourly rate for the *whole* of the visible sky.—Doubling this to include the invisible hemisphere, we have 120 per hour; multiplying this by the number of hours in a day, we get 2880 as the diurnal rate, and finally by the 20 days, through which my watches endured, we have for our product 57,600.

These, however, merely represent the number clearly visible to the eye on a cloudless starlit night. The number *invisible* must have been vast indeed, and beyond all conception. There are probably hundreds of thousands of these minute planetary stones falling into our atmosphere every day, and too small to be discerned with the unaided eye. It must not be imagined however that the horary number of visible shooting-stars, as I observed them this October, is maintained during the whole year. It is excessive, for the spring months are usually less prolific than the autumnal months.

From my own observation of 2081 meteors during the last five months (July-Nov.), in 149¾ hours and a half watching (about equally divided between a. m. and p. m.), the hourly number was 13.3 and from this computation I have excluded the *Perseids* (385), which is such a numerous system that to include it in any calculation of the average hourly numbers percepceptible on ordinary nights of the year would be manifestly unfair, though it is equally certain that it cannot be excluded from any investigations as to the annual or monthly number of visible shooting-stars. Excluding this rich shower, however, for the present, and taking 13.3 as the horary rate of the last five months, we may easily calculate that if this is maintained during the year, we have annually more than 930,000 meteors entering our atmosphere, at least equal to 5th magnitude stars.

If we include the great *Perseid* system of August, the number would be much greater (in fact 1.163,330), for on August 10th last alone, I calculate that fully 10,000 visible fragments of this single shower fell towards the earth. Such facts amply prove the enormous numbers of these bodies that ac-

tually exist in space, and show what a vast, rich field there is here for observation and investigation. There are not only great numbers of individual shooting stars, but also great numbers of systems to which they belong. My October observations alone were sufficient to clearly prove the radiant points of 47 such systems, and about twenty others were less certainly indicated, and it must be remembered that nearly all my observations were directed towards the N. W. and N. E. sky, so that many showers from the S. and S. W. altogether escaped me.

On very reasonable grounds it may be accepted that at least 100 separate and distinct meteor systems were actually in play during the first 20 days in October! Chief of them all was the well known shower of *Orionids* from which I saw about 57 meteors between the 14th and 19th in the morning sky, and I observed many other well marked and tolerably active showers of which the most important apparently are noted in the following table :—

CHIEF METEOR SHOWERS FROM OCTOBER 1-20, 1877.

No.	Radiant point. R. A. o	Dec. N. o	No. of Meteors observed	Notes.
1.	92	15	57	The *Orionids*.
2.	105	50	15	A new shower in the Lynx.
3.	133	79	22	From Comet II, 1825. Radiant 134°+ 77 Oct. 7, (A. S. Herschel).
4.	225	52	10	A new shower chiefly Oct. 2.
5.	133	21	18	In Cancer, seen before sunrise.
6.	103	12	22	Active showers seen also in Sept. and November.
7.	115	29	13	The *Gemellids* seen also in Nov.
8.	84	55	18	The *Aurigids* " " Sept.
9.	108	38	16	A marked shower N. of Alpha Geminorum.
10.	310	77	17	An active shower, chiefly Oct. 2-5.

No. 2 in this table has been continued during the present month of Nov., and altogether I have 37 meteors from it. It is extremely probable that this well-marked radiant has only come actively into play during the last two or three years, and it will be important to re-observe it in future years. Prof. Herschel recently said that "Great interest is attached to accurate observations of the course of meteors, for the determination of a meteor orbit ranks in Astronomy with the discovery of a planet." This ought to encourage observation among those who have the opportunity and the desire. No instruments are required to be employed, but the work is, it is true, none the less tedious and difficult on that account. Night after night, month after month, year after year, the sky must be watched, and every shooting-star recorded as it falls! The work is one in which much patience and effort are required. To stand watching the sky 3 or 4 hours on a cold winter's night with perhaps meagre results, must often prove a wearisome, monotonous un-

dertaking, yet it is astonishing how soon we may become habituated to such work, and lose the impatient feeling at first experienced. I remember that, about eighteen months ago, when I began systematically to observe shoot-stars, a watch of two hours required something of an effort to sustain it, whereas, now I continue at work for 5, 7 or ten hours at a time and it is always a pleasant occupation. On a night when meteors are numerous, there is quite an enjoyable excitement, and it is suprising that so few astronomers engage in this special work. Verily, herein the harvest is great and the laborers are few. Though much has already been gathered, we stand as yet only on the outskirts of the rich field of discovery, and I would earnestly invite the members of your society to take some share in the work. Mr. Sawyer, your Secretary, who is himself getting together many useful facts in this department will, I know, be happy to lend a helping hand and give such directions as will ensure valuable and honorable results.—*Science Observer.*

BRISTOL, ENGLAND, Nov. 15, 1867.

HOW THE EARTH APPEARS FROM THE OTHER PLANETS.

"How many eyes are watching us?" is an instinctive thought as one steps out under the glittering dome at night.

It is rather humiliating to learn from astronomers that we are visible only to the Moon, Mercury, Mars and Venus, out of all those myriad lights.

At certain favorable times Jupiter might see us with the aid of a telescope, but it would be only as a small black spot slowly crossing the sun's face.

We are invisible to Saturn. Even if, by the aid of powerful telescopes they could see us, they could not decide whether we were a distinct or seperate ball or attached to the sun.

An imaginary view from Saturn is supposed to depict the scene at midnight, at thirty degrees latitude. The sun has illuminated the beautiful rings, casting a brighter glow over the faint yellowish tint of the orb. The equatorial belt of a creamy white color, the cinnamon-colored belts on either side, and the faint blue of the polar regions, shine more vividly in the reflected light. The satellites sparkling in the distance heighten the grandeur of the scene.

We receive but very faint light from Saturn, as we are 746 times smaller than that planet, and its mean distance from us, according to Proctor, is over 91,000,000 miles.

Uranus can never see us at all, as it is 1,753,000,000 miles from the sun.

Neptune, the most remote of the planets in the solar system, is about, 2,700,000,000 miles from the sun. As we only discovered it about thirty years ago, it need not disturb us to think that the Neptuneites will never know of our existence.

Before inquiring how we look from the planets, let us first learn a little about them, beginning with Mercury, as it is nearest to the sun. The Greeks called it "glittering," on account of the occasional intensity of its light. An old English writer, Goad, in 1686, humorously calls this planet "a squinting lackey of the sun, who seldom shows his head in these parts, as if he were in debt." From its extreme mobility, chemists adopted this planet as the symbol for quicksilver.

It is supposed that Mercury has mountains higher than our Himalayas, and volcanoes in a state of activity. The planet must be very dense in character. If its materials were similar to those of our earth they would melt in a short time, on account of the proximity of the planet to the sun. The temperature in Mercury is supposed to be seven times hotter than our Torrid Zone. Therefore, if it is inhabited it must be by people very differently constituted from ourselves.

Fontenelle's idea of Mercury and its inhabitants is so very curious and interesting as to be worth quoting. It will easily be seen that his imagination is a powerful one. He says: "The heat to which they are accustomed is so great that the climate of Central Africa would freeze them through. It must be taken for granted that our iron, silver nnd gold would melt in their world, and only appear as a liquid like water. The dwellers in Mercury must be so vivacious as to be mad in our meaning of the term. I believe that they have no more memory than most negroes, that they have not the faculty of thought, that they only act by fits and starts, and that in Mercury Bedlam is the universe."

If these singular people would enjoy seeing us, the best time for them would be when we are on a right line with their planet and the sun. Our illuminated side is then turned toward them. By climbing the steep crags shown in the view (which Schroter says are ten miles high), and looking off into the sky they would see our globe as a magnificent and stately star, moving from west to east, as shown in the figure. Through a good telescope they might see dusky patches here and there, defining the outlines of our continents. Light green tracts would show our seas and oceans. They could see our polar regions white with snow. It is probable, however, that only their Ross' telescope would show these markings.

Venus is the only planet mentioned by Homer. He speaks of it as "beautiful." It was called "Sukra" or "the brilliant," by the Indians. It is often called the "Shepherd's Star," Hesper or the "evening star," and Lucifer, the "morning star." Venus is so bright that it may often be seen at midday with the naked eye. It is supposed there are mountains also on this planet. Halley, the great English astronomer, was the first to announce the fact that the passage of Venus across the sun gave us the means of obtaining the sun's exact distance from the earth.

It is generally admitted that this planet has an atmosphere much like ours. The author of the "Harmonies of Nature," speaking of Venus and its inhabitants, says: "Venus must have mountain peaks five or six times

higher than Teneriffe, their sides bright with flowers and birds of brilliant plumage.

"Its inhabitants about the same size as ourselves, since they dwell in a planet of the same diameter, but in a more favored celestial zone, must devote all their time to love."

Could the people of Venus spare time enough from such an agreeable occupation to study their skies, when their planet is nearest to our earth, they would be repaid by a magnificent sight. Our globe would appear to them as a brilliant star, tinged a delicate blue, and larger than any in their sky. With suitable telescopes they would have much the same view of our earth as from Mercury, except that the configurations would be more distinctly marked. The author we have just quoted, in speaking of the brilliancy of the earth, as seen from Venus, says: "Though the long nights in Venus have no moons to light them, Mercury, by reason of its brilliancy and close vicinity, and the earth, by reason of its size, must be more than equal to two moons.

The moon never leaves our globe; therefore it is called our satellite. Though to us it appears larger than the stars, it is really smaller than any of them. Its seeming size is on account of its nearness to the earth, it being distant from us only about 238,000 miles.

The surface of the moon is covered with black spots, which can be seen with the naked eye. Through the telescope it can be seen that they are mountains and extinct volcanoes. Astronomers have calculated that these mountains are higher than any on our earth.

The moon has no atmosphere, according to Sir John Herschel and other careful and accurate observers. If it had we would know it during the occulations of stars and eclipses of the sun. The moon's climate must therefore be very strange, passing suddenly from a heat equal to our torrid zine, to cold greater than the Esquimaux feels. As there is no air, it seems impossible that human beings like ourselves can exist on the moon. There is no sign of vegetation or anything which would indicate a change of seasons. If there were any one on the moon to see it, the earth would appear to them as a magnificent ball. The planets and sun would move behind it in brilliant succession.

The earth has phases like the moon; when it is at its full, the scene is grandest. The basins of our seas and oceans, the contour of our continents, the north and south poles wearing their snowy caps—all these could clearly be seen shining through a vaporous halo. With the aid of a very powerful glass, the avenues of New York and the big trees of California might be seen.

The planet Mars is our next door neighbor, and much resembles us in "atmospheric phenomena and polar cold." To the naked eye it is not very brilliant. Judging by its reddish hue, it is surrounded by a dense atmosphere. We know this because the stars which it passes are hidden before they are eclipsed by the globe of Mars itself.

The name of Mars in Hebrew signifies "ignited;" with the Greeks Mars meant "incandescent;" the Indians called it "Anagraka," which means "burning coal," and the "red body."

Henri de Parkville, in his book, "An Inhabitant of the Planet Mars," gives us a most entertaining account of the supposed discovery of one of these creatures in an ærolite which fell and was found in America. In the portrait of the gentleman, his nose begins at the top of his head and extends down to his mouth, looking much like the short trunk of an elephant. Our readers must make allowance, however, for a French imagination.

Our globe appears to Mars but as a bright star. The earth is nearest to Mars when between it and the sun, but at that time its dark side is turned toward Mars, and of course it is not visible to that planet.

It is therefore only visible to Mars when it is partly illuminated by the sun. Even then it is bright enough to be seen in the daytime. Our earth appears as the morning and evening star to this planet.—*Christian Weekly.*

MEDICINE AND HYGIENE.

HOW TO USE STIMULANTS.

The British Medical Journal of November 10th contains a paper "On the Medical Injunction of Stimulants in Disease and Health." by Dr. Dyce Duckworth, F. R. C. P., whose eminence as a physician will commend his words to the faculty, while the clear common sense of his inferences will be found a sufficient recommendation of them to the lay readers of the *Times*. Dr. Duckworth agrees that the reproach cast upon England for its notorious drunkenness is utterly grievous. The question, he says, is one for the the clergy and the doctors. When the doctors agree and lay down principles to guide the clergy the two professions will be able to lay an irresistible case before Parliament. It is discreditable to the profession, he thinks, that they should be divided, not in opinion, but about facts. There is no middle course: stimulants are all right if rightly used; or all wrong if used at all or in any degree. Dr. Duckworth then gives what he holds and sees to be the true and legitimate position of thoughtful medical men in respect to the use of stimulants in disease. He groups the diseases in whose treatment alcohol is and is not of use, and concludes that there is no routine in the matter of employing stimulants. "We put alcohol, with its congeners, into our therapeutic armamentarium; it is to hand when wanted, just as are quinine, calomel, the lancet or the cupping-glass. We cannot do without it or any of these things, but we employ them or not, as our bedside knowledge indicates."

"But is alcohol or wine food? Some physiologists tell us no. I do not believe them. I am fully satisfied of the nutrient powers of wine and alcohol alone, under some conditions, or more especially in conjunction with other pabula." Stimulants, Dr. Duckworth continues, are not necessary to healthy and well fed people, leading what may be termed normal lives. To them they are a luxury, and not necessarily pernicious. But how many people persistently lead normal lives? He is not prepared to say that a little good beer is not a very valuable addition to the often scant fare and coarse food of working people, or that it may not fairly be taken to counteract, as it will, the many sources of depression to which such people are inevitably exposed in Great Britain. If they cannot get good beer, then the Legislature is at fault. Medical men may fairly tell the healthy, robust, well-fed and well-housed to give up stimulants if they fully maintain their health without them. Total abstainers are generally large eaters, and the ultimate textural effects of excess in eating or drinking, if any, may not be very dissimilar. "I think it is proved," says Dr. Duckworth, "that the addition of a little alcoholic food to a meal secures a more moderate ingestion of solids, and where it agrees, which it does not always, promotes a more satisfactory digestion of them. But a large number of persons suffering chiefly from dyspepsia or insomnia are better without stimulants of any kind. A "daily allowance" of alcohol is manifestly wrong; more to-day and less to-morrow may be needed or extinctively called for. "The rational individual must find out for himself what the special needs of his system are; and where a right-minded Christian individual is in earnest in such a matter, and has a proper control over his appetite, he is not likely to go far wrong in the matter of stimulants."

Medical men should urge teetotalism upon the nervous class of drunkards, persons who are careless and self-indulgent, or who by their lives or calling are much in the way of drink. Stimulants should always be taken at meal times, and only then. "I am confident," Dr. Duckworth says, "that as a body our profession is unanimous in condemning the modern American habit of taking odd glasses of stimulant at all hours, and laments the grievous multiplication of the means of gratifying this mischievous custom, for truly the conduct of the masses of young business men in our cities and large towns, in this respect is becoming disgraceful, and the practice is fast gathering in other circles and communities. Our countrymen of these classes have no excuse for this, for they are well-fed and they have liquors with their meals in addition to their hourly drams, while Americans, who are notoriously the worst dieticians in the civilized world, are water-drinkers at meal-times."?

No serious results, in Dr. Duckworth's opinion, follow the sudden cutting off of stimulants from hard drinkers or delirium tremens patients.—As to teetotal societies, he says:

"I believe that a mission against the drinking habits of all classes and

communities, conducted upon the principles of total abstinence, is a hopeless one to embark upon. It is simply to fight the air. Little can, in the nature of thing, come of it. A crusade against our greivously prevalent intemperance, * * * conducted on principles of true moderation and sobriety, is a very different matter. * * * I flatly refuse to believe that the broad stream of common sense and legitimate freedom in this, or any other like matter, has flowed for centuries in a wrong channel, and that we alone in our day are called upon not only to divert but to dam it up for all future time."

Dr. Duckworth, however, does not decry but applauds "the noble example of total abstention from strong drink, set by the clergy and others in conspicuous positions." "We as a body," he says, "are at all events unable to resist the evidence they bear to the effect that their principles alone in many cases enable them to reclaim drunkards and achieve results that would otherwise be impossible.

CURARE IN HYDROPHOBIA.

John Moss, F. C. S., gave in the *Pharmaceutical Journal* of last month, a complete summary of the history, description and chemical composition of Curare, now again proposed in England as a remedy for hydrophobia.

In regard to the administration of the drug, he says:

The properties of curare preclude its medicinal use in any other form than that of a solution for hypodermic injection. For such a solution to be ready for use at all times, certain characteristics are essential, or at least highly desirable. It must be of convenient strength, so that the dose fixed upon may bear a simple relation to the number of minims, yet not so strong that the injection of a quantity slightly in excess of what was intended may be of too great importance, and not so diluted that the maximum dose is inconveniently large. The solution should produce as little pain as possible when injected; having regard to the fact that rabies patients have an intensified dread of pain, this characteristic is perhaps more important in the particular solution now under consideration than in any other. The solution should not only be at all times prepared of the strength that it professes to be, but should keep well, and remain of that strength. To prepare a uniform solution of a drug so deadly and variable as curare, one should always have recourse to the same parcel, of which the strength has been proved. Curarine or one of its salts might be used, but independently of the grave risks incurred in preparing them, we are as yet without trustworthy data upon which to frame a formula.

The keeping power of a solution will depend in a great measure on the menstruum. Water would produce a solution giving the minimum of pain when injected, and Taylor's statement that Bernard preserved curare in solution of water for two years without any loss of its power is confirmed by the experience of Dr. Lauder Brunton, who informs me that he has kept a

very weak solution (1 in 1000) for the same period without change. I have prepared solutions of curare in the following menstrua, viz., water, water with 0.2 per cent. of salicylic acid, diluted spirit of wine (I to 3). The last forms by far the best looking solution and is also the best solvent. It dissolves 85.2 per cent. of curare when left in contact with it for twenty-four hours and filtered; the dried residue hardly imparts any tinge to water. Water dissolves 83 per cent. and diluted spirit 79 per cent. of curare, and the dried residue in each case gives a decided tinge to water; both solutions are iridescent on the surface and at the side when examined in a glass vessel, and commence to deposit soon after being filtered. The glycerine solution deposits to a much smaller extent.

It appears, however, from observations kindly communicated to me by Dr. Ashburton Thompson, that even so weak a solution of glycerine as that indicated above, viz., 25 per cent. is productive of great pain when injected; and seeing that the aqueous solution keeps very well, I would propose the following formula as best meeting the requirements of the case:—

HYPODERMIC INJECTION OF CURARE.

Curare.....gr. j.
Water.....min.xij.

Dissolve; let the solution stand forty-eight hours and filter.

Using this solution two-thirds, a half, third, or quarter of a grain may be given in a whole number of minims. Of the other strengths likely to suggest themselves, viz., one in ten and one in fifteen, the first would only allow of a tenth and a half a grain; and the second, of a fifteenth, a third, and two-thirds of a grain being given in the same way. The accounts of the use of curare seem to indicate that the dose is from a quarter to a half grain.

CAUTION.—Curare requires to be handled with the utmost care. It should not be allowed to come into contact with a fresh cut or a scratch. Two good rules would be, never to powder it in dry condition and never to touch it with naked fingers.—*Druggists Circular.*

TARTAR ON TEETH.

BY A. H. TREGO, D. D. S.

Dentist are continually asked: "What is tartar, and why does it collect on teeth?" Practically, two words answer the two questions: "Indigestion" and "carelessness."

Commercially, tartar is an *acid concrete salt*, produced by fermentation of wine, and is found incrusted on the inside of old wine casks.

"Tartar" on teeth consists of *salivary mucus, animal matter and phosphate of lime.* ("Brown rust," "Caries" and erosions of the enamel are quite different from tartar.)

Tartar is more prevalent in the mouths of "dyspeptics" and in those of persons of "good constitution" who eat rapidly and leave the stomach to

finish what the teeth and mastication should have performed. The stomach may not be considered "disordered," but it is made torpid by unmasticated food being forced into it thereby causing "fermentation" instead of allowing natural digestion. (Dr. Abernathy said that "nine tenths of the ills of humanity arise from stuffing and fretting")

The acidulated gas produced by the process of fermentation, rises from the stomach to the mouth; and having an affinity for the saliva and particles of food, a deposit of tartar is the inevitable result. Tartar does not decay the teeth, but inflames, devitalizes and destroys the gums and membranes of the sockets, and thereby loosens the teeth. Once started, it accumulates rapidly, and many persons are ignorant of its presence until great injury is done to the teeth, and surrounding parts. The worst thing to do, however, is to conclude that teeth thus affected, are not worth saving. Reconstructed natural teeth are greatly superior to the best of artificial dentures.

Persons who have lived to the age of maturity in the East, ask "why does tartar accumulate more rapidly in the West?" (A noticeable fact.) Without having made a careful chemical analysis, I have no hesitation in declaring it to be attributable to the superabundance of alkali in the western water. This alkali has a powerful affinity for the acids and gases of the mouth and stomach; and by immediate contact they immediately neutralize each other and form a sediment that unites with the mucus and foreign substances, and produce the concretion.

No chemical preparation will remove tartar without first destroying the teeth. The only successful remedy, is the scaler in the hands of operators who are willing to devote skill and patience to an apparently trifling operation. The most practical preventative, is a reliable dissolvent wash and daily use of good brushes.

N. B.—Never use dentifrices containing soap, charcoal, orris root, alkali, acid or froth.

ARSENICAL ANTIDOTES.—From some late experiments Rouyer has found that although the freshly precipitated sesquihydrate of iron is an antidote for arsenious acid, it has no effect in counteracting the action of sodic arseniate or potassic arsenite (Fowler's solution), but that a mixture of a solution of the sesquichloride of iron and the oxide of magnesium will counteract the effect of these salts as well as the arsenious acid itself, and hence this mixture is always preferable to the hydrate in cases of arsenic poisoning. The officinal solution of the sesquichloride of iron should be first administered, and fifteen minutes afterward the magnesia oxide, given in the proportion of four grammes of the latter to one hundred cub. cent. of the former. In one hour after the administration of the antidote a cathartic should be given. The ingestion of acid drinks and lemonade should be avoided during the entire treatment, since the compounds formed by the union are soluble in acids.—*Rep. de Pharm.*

VANCE'S CREAM FOR CHILBLAINS.—Ointment of mercuric nitrate, 1 ounce; Camphor, 1 drachm; Oil of turpentine, 2 drachms; Oil of olives, 4 drachms. Mix well. To be applied with gentle frictions before the chilblains break.

ALMOND POWDER FOR THE HANDS.—Almonds blanched and powdered, 1 pound; powdered white Castile soap, 8 ounces; powdered Orris root, 2 ounces; powdered Pumice stone, 4 ounces; oil of bitter almond, 2 drachms.

LEMON CORDIAL.—Fresh lemon peel, 2 ounces; fresh orange peel, 1 ounce; dry lemon peel, 2 ounces; diluted alcohol, 1 gallon; water and syrup, of each, 6 pints.

SCIENTIFIC MISCELLANY.

TYNDALL ON SPONTANEOUS GENERATION.

Prof. Tyndall delivered the opening lecture of the winter session at the London Institution on December 10. He said that within ten minutes' walk of a little cottage which he has recently built in the Alps, there is a small lake fed by the melted snows of the upper mountains. During the early weeks of summer no trace of life is to be discerned in this water, but invariably toward the end of July or beginning of August swarms of tailed organisms are seen enjoying the sun's warmth along the shallow margins of the lake, and rushing with audible patter into the deeper water at the approach of danger. The origin of this periodic crowd of living things is by no means obvious. For years Dr. Tyndall has never noticed in the lake either an adult frog or the smallest fragment of frog's spawn, so that were he not otherwise informed, he should have found the conclusion of Mathiole a natural one—namely, that tadpoles are generated in lake mud by the vivifying action of the sun. The checks which experience alone can furnish being absent, the spontaneous generation of animals quite as high as the frog in the scale of being was assumed for ages as a fact. For nearly twenty centuries after Aristotle men found no difficulty in believing in cases of spontaneous generation which would now be regarded as monstrous by the most fanatical supporters of the doctrine. Redi, in 1668, by careful experiments, destroyed the belief in the spontaneous generation of maggots in putrid meat. The combat was continued by Vallisneri, Schwammerdam and Reaumur, who succeeded in banishing the notion of spontaneous generation from the scientific minds of their day. As regards the complex

organisms they dealt with, the notion was banished forever. But the discovery of the microscope, revealing a world of life formed of individuals so minute—so close, as it were, to the ultimate particles of matter—as to suggest an easy passage from atoms to organisms, revived the dying doctrine. Dr. Tyndall now traced its support by Buffon and Needham, (1748) and the experiments with a contrary tendency of Spallanzani, (1779) Schulze, (1836) Schwann, Helmholtz, Schroeder, and Von Dusch. In 1859 Pouchet, a vigorous and ardent writer, strongly influenced opinion in favor of spontaneous generation. In view of the multitudes of motes required to produce the observed results, he ridiculed the assumption that there are atmospheric germs. If there were, indeed, said he, the number that are mathematically required, the air would be entirely obscured by them. The germ clouds would be much thicker than the rain clouds. But had Pouchet known that the blueness of the ethereal sky is actually due to the suspension of innumerable particles in the air upon which the sun shines, he would hardly have ventured on this line of argument. Pasteur, however, published his classical paper in 1862, and his main position has never been shaken. He has applied the knowledge won from his inquiries to the preservation of wine and beer, to the manufacture of vinegar, and to the staying of the plague which threatened destruction to the silk husbandry in France. Prof. Lister has thanked him in a published letter for having furnished the only principle which would have conducted the antiseptic system in surgery to a successful issue. Our knowledge has been greatly extended by Prof. Cohn, of Breslau. "No putrefaction," he says, "can occur in a nitrogenous substance if its bacteria be destroyed and new ones prevented from entering it." Bacteria are the minute animals, so called from the rod-like appearance of some of them, which are now thought to be at the root of the disease as well as of putrefaction. According to this view, a contagious fever may be defined as a conflict between the person smitten by it and a specific organism which multiplies at his expense, appropriating his air and moisture, disintegrating his tissues, or poisoning him by the decompositions it causes.

Prof. Tyndall proceeded to refer very briefly to his own studies on the subject since 1869, and more in detail to his experiments made this summer on the Bel-Alp, above the Rhone valley, the spot 7,000 feet above the sea being selected for the sake of the purity of the air and its freedom from organisms. In describing an actual experiment he would assume he was accompanied by some eminent and fair-minded member of the medical profession, who entertained views adverse from his, because it was obvious that to an important portion of the medical press of London he had not as yet succeeded in rendering this question clear. Sixty flasks would be filled in the manner described in the lecture, with an infusion of beef, mutton, turnip and cucumber, sterilized by boiling and hermetically sealed. They are transported to the Alps. It is the month of July, and the weather is favorable to putrefaction. At the Bel-Alp fifty-four flasks are counted out

with their liquids as clear as filtered drinking water. In six flasks, however, the infusion is found muddy. On examination, it is discovered that every one of these has its fragile end broken off in the transit from London. Air has entered the flasks, and muddiness is the result. Examined with a pocket-lens, or even with a microscope of insufficient power, nothing is seen in the muddy liquid; but regarded with a magnifying power of a thousand diameters, what an astonishing appearance does it present? Leeuwenhoek estimated the population of a single drop of stagnant water at 500,000,000; probably the population of a drop of our turbid infusion would be this ten times multiplied. The field of the microscope is crowded with organisms, some "wobbling" slowly, others shooting rapidly across the microscopic field. They dart hither and thither like a rain of minute projectiles; they pirouette and spin so quickly round that the retention of the retinal impression transforms the little living rod into a twirling reel. And yet the most celebrated naturalists tell us that they are vegetables. Has this multitudinous life been spontaneously generated in these six flasks, or is it the progeny of living germinal matter carried into the flask by the entering air? If the infusions have a self-generative power, how are the sterility and consequent clearness of the fifty-four uninjured flasks to be accounted for? It has been affirmed in support of the theory of heterogeny that the vacuum above the infusion is favorable to the production of organisms, and their absence from tins of preserved meats, fruit and vegetables is accounted for by the hypothesis that fermentation has begun in such tins, that gases have been generated, the pressure of which has stifled the incipient life and stopped its further development. But in well preserved tins, Dr. Tyndall has invariably found, not an outrush of gas, but an inrush of water, if they were perforated under water. He has noticed this in modern tins, and in tins which have been perfectly good for sixty-three years. On the other hand, he has exposed the organisms to pressure of gases without killing them. The fifty-four pellucid flasks declare against the heterogenist. The flasks are next exposed to a warm Alpine sun by day, and at night suspended in a warm kitchen. Four of them have been accidentally broken, but at the end of a month the fifty remaining flasks are found as clear as at the commencement. There is no sign of putrefaction or of life in any of them.

These flasks are divided into two groups of twenty-three and twenty-seven respectively. The question now is whether the admission of air can liberate any generative energy in the infusions. The flasks are carried to a hay-loft and the ends snipped off from the group of twenty-three. The twenty-seven flasks are borne to a ledge 200 feet higher, from which the mountain falls away precipitously to the northeast for about 1,000 feet. A gentle wind blows toward it from the northeast, across the crests and snow fields of the Bernese Oberland. The spot is, therefore, bathed in air which must have been for a good while out of contact with either animal or vegetable life. Standing carefully to the leeward of the flasks, for no dust or

particle from their clothes or bodies must be blown to the flasks, the operators first singe the pliers in a spirit lamp to destroy all attached germs or organisms, and then snip off the sealed end of the flask. In this way the twenty-seven flasks are charged with clean, vivifying mountain air. The fifty flasks are placed with their necks open over a kitchen stove in a temperature varying from 50° to 90° Fahrenheit, and in three days twenty-one out of the twenty-three flasks opened in the hay-loft are found to be invaded with organisms. After three weeks' exposure to precisely the same condition, not one of the twenty-seven flasks opened in free air had given way. No germ from the kitchen air had ascended the narrow necks, the flasks being shifted to produce this result. They are still in the Alps, as clear (the speaker doubted not) and as free from life as they were when sent off from London. Is not the conclusion, he asked, imperative that it was not the air, but something in the air, which produced the effects observed in the flasks placed in the hay-loft? What is this something? A sun-beam glinting through a chink in the roof or wall, and traversing the air of the loft, which was in free communication with an open door-way with the outer air, would show this air to be laden with suspended dust particles. Can they have been the origin of the observed life? If so, we are not bound by all antecedent experience to regard these fruitful particles as the germs of the life observed?

Dr. Tyndall proceeded to indicate the test of what he described as one of the principal foundations of heterogeny as promulgated in this country. He would place before his friend and co-inquirer, the candid medical critic before assumed, two liquids which had been kept for six months in a sealed chamber exposed to optically pure air. The one is a mineral solution, containing in proper proportion all the substances which enter into the composition of bacteria; the other is an infusion of turnip. Both liquids are as clear as distilled water, and there is no trace of life in either of them. A mutton chop, over which a little water has been poured to keep its juices from drying up, has lain for three days upon a plate in a warm room. It smells offensively. Placing a drop of the fetid mutton-juice under a microscope, it is found swarming with the bacteria, which live by putrefaction, and without which no putrefaction can occur. With a speck of the swarming liquid, the clear mineral solution and the clear turnip infusion are each inoculated. In twenty-four hours the transparent liquids have become turbid throughout, and instead of being barren as at first, they are teeming with life. The experiment is now varied. Opening the back door of another closed chamber which has contained for months the pure mineral solution and the pure turnip infusion, into each is dropped a small pinch of laboratory dust. The effect is tardier than when the speck of putrid liquid was employed. In three days, however, after its infection with the dust, the turnip infusion is muddy, and swarming as before with bacteria. But what about the mineral solution, which in the first experiment behaved in a manner undistinguishable from the turnip-juice? At

the end of three days, at the end of three weeks, it is innocent of bacterial life. While both liquids are able to feed the bacteria, and to enable them to increase and multiply after they have been once fully developed, only one of the liquids is able to develop the germinal dust of the air into active bacteria. The mineral solution, to take an illustration from higher life, can feed the chick but can not develop the egg. But this is not the inference which has been drawn from experiments with the mineral solution. Seeing its ability to nourish bacteria when once inoculated with the living, active organism, and observing that no bacteria appeared in the solution after long exposure to the air, the inference was drawn that neither bacteria nor their germs existed in the air. Throughout the Germany the ablest literature is infected with this error. The death-point of bacteria is another important subject. The experiments already recorded show that there is a marked difference between the dry germinal matters of the air, and the wet, soft and active bacteria of the putrefying organic liquids. The one can be luxuriantly bred in the saline solution, the others refuse to be born there, while both of them are copiously developed in a sterilized turnip infusion. If we boil our muddy mineral solution, with its swarming bacteria, for five minutes, not one of them escapes destruction in the soft, succulent condition in which they exist in solution. The same is true of the turnip infusion, if it be inoculated with the living bacteria only—the ærial dust being carefully excluded. But the case is entirely different when we inoculate our turnip infusion with the desiccated germinal matter afloat in the air. Dr. Tyndall proceeded to explain the system of killing germs by boiling a liquid repeatedly for a short time. Those which are not killed begin to sprout, and are destroyed at the next boiling, when they are in their most tender, helpless and unprotected condition.—*Nature.*

THE TALKING PHONOGRAPH.

Mr. Thomas A. Edison recently came into this office, placed a little machine upon our desk, turned a crank, and the machine inquired after our health, and asked how we liked the phonograph, informed us that *it* was very well, and bid us a cordial good night. These remarks were not only perfectly audible to ourselves, but to a dozen or more persons gathered around, and they were produced by the aid of no other mechanism than the simple little contrivance explained and illustrated below.

The principle on which the machine operates we recently explained quite fully in announcing the discovery. There is, first, a mouth piece, A, across the inner orifice of which is a metal diaphragm, and to the centre of this diaphragm is attached a point, also of metal. B is a brass cylinder supported on a shaft which is screw-threaded and turns in a nut for a bearing, so that when the cylinder is caused to revolve by the crank C, it also has a horizontal travel in front of the mouthpiece, A. It will be

clear that the point on the metal diaphragm must, therefore, describe a spiral trace over the surface of the cylinder. On the latter is cut a spiral groove of like pitch to that on the shaft, and around the cylinder is attached a strip of tinfoil. When sounds are uttered in the mouthpiece, A, the diaphragm is caused to vibrate and the point thereon is caused to make contacts with the tinfoil at the portion where the latter crosses the spiral groove. Hence, the foil, not being there backed by the solid metal of the cylinder, becomes indented, and these indentations are necessarily an exact record of the sound which produced them.

It might be said at this point the machine has already become a complete phonograph or sound writer, but it yet remains to translate the remarks made. It should be remembered that the Marey and Rosapelly, the Scott, or the Barlow apparatus, which were cently described, proceeded no further than this. Each has its own system of caligraphy, and after it has inscribed its peculiar sinuous lines it is still necessary to decipher them. Perhaps the best device of this kind ever conceived was the preparation of the human ear made by Dr. Clarence A. Blake,' of Boston, for Professor Bell, the inventor of the telephone. This was simply the ear from an actual subject, suitably mounted and having attached to its drum a straw, which made traces on a blackened rotating cylinder. The bifference in the traces of the sounds uttered in the ear was very clearly shown. Now there is no doubt that by practice, and the aid of a magnifier, it would be possible to read phonetically Mr. Edson's record of dots and dashes, but he saves us that trouble by literally making it read itself. The distinction is the same as if, instead of perusing a book ourselves, we drop it into a machine, set the latter in motion, and behold! the voice of the author is heard repeating his own composition.

The reading machine is nothing but another diaphragm held in the tube, D, on the opposite side of the machine, a point of metal which is held against the tinfoil on the cylinder by a delicate spring. It makes no difference as to the vibrations produced, whether a nail moves over a file or a file moves over a nail, and in the present instance it is the file or indented foil strip which moves, and the metal point is caused to vibrate as it is affected by the passage of the indentations. The vibrations however, at this point, must be precisely the same as those of the other point which made the indentations, and these vibrations, transmitted to a second membrane, must cause the latter to vibrate similar to the first membrane, and the result is a synthesis of the sounds which, in the beginning, we saw, as it were, analysed.

It is a little singular that the machine pronounces its own name with especial clearness. The crank handle shown in our perspective illustration of the device does not rightly belong to it, and was attached by Mr. Edison in order to facilitate its exhibition to us.

In order that the machine may be able exactly to reproduce given sounds, it is necessary, first, that these sounds should be analyzed into vibrations,

and these registered accurately in the manner described; and second that their reproduction should be accomplished in the same period of time in which they were made, for evidently this element of time is an important factor in the quality and nature of the tones. A sound which is composed of a certain number of vibrations per second is an octave above a sound which registers only half that number of vibrations in the same period. Consequently if the cylinder be rotated at a given speed while registering certain tones, it is necessary that it should be turned at precisely that same speed while reproducing them, else the tones will be expressed in entirely different notes of that scale, higher or lower than the normal note as the cylinder is turned faster or slower. To attain this result there must be a way of driving the cylinder, while delivering the sound or speaking, at exactly the same rate as it ran while the sounds were being recorded, and this is perhaps best done by well regulated clockwork. It should be understood that the machine illustrated is but an experimental form, and combines in itself two separate devices—the phonograph or recording aparatus, which produces the indented slip, and the receiving or talking contrivance which reads it. Thus in use the first machine would produce a slip, and this would for example be sent by mail elsewhere, together in all cases with information of the velocity of rotation of the cylinder. The recipient would then set the cylinder of his reading aparatus to rotate at precisely the same speed, and in this way he would hear the tones as they were uttered. Difference in velocity of rotation within moderate limits would by no means render the machine's talking indistinguishable, but it would have the curious effect of possibly converting the high voice of a child into the deep bass voice of a man, or *vice versa*.

No matter how familiar a person may be with machinery and its wonderful performances, or how clear in his mind the principle underlying this strange device may be, it is impossible to listen to the mechanical speech without experiencing the idea that his senses are deceiving him. We have heard other talking machines. The Faber apparatus for example, is a large affair, as big as a parlor organ. It has a key board, rubber larynx and lips and an immense amount of ingenious mechanism which combine to produce something like articulation in a single monotonous organ note. But here is little affair of a few pieces of metal, set up roughly on an iron stand about a foot square, that talks in such a way, that, even if in its present imperfect form many words are not clearly distinguishable, there can be no doubt no that the inflections are those of nothing else than the human voice.

We have already pointed out the startling possibility of the voices of the dead being reheard through this device, and there is no doubt but that its capabilities are fully equal to other results just as astonishing. When it becomes possible, as it doubtles will, to magnify the sound, the voices of such singers as Parepa and Titiens will not die with them, but will remain as long as the metal in which they may be embodied will last. The witness in court will find his own testimony repeated by the machine confronting

him on cross examination—the testator will repeat his last will and testament into the machine so that it will be reproduced in a way that will leave no question as to his devising capacity or sanity. It is already possible by ingenious optical contrivances to throw stereoscopic photographs of people on screens in full view of an audience. Add the talking phonograph to counterfeit their voices, and it would be difficult to carry the illusion of actual presence much further.—*Scientific American*, *December* 22*d.*, 1877.

Mr. Thomas A. Edison, the inventor of the talking phonograph which we recently described, informs us that he has constructed a new and larger machine which not merely speaks with all the clearness which we predicted would be obtained, but loud enough to be audible at a distance of 175 feet. —*Scientific American*, *Jan.* 5, 1878.

LAMP-LIGHTING BY ELECTRICITY.

Such is the progress the science of electricity is making in the hands of its practical exponents, that we have now to record the fact that any number of the street lamps can be dealt with—that is London or any other town can have the whole of its public gas lamps turned on, lighted, and turned off instantaneously, with ease and, so far as at present has been seen, with certainty. The highly ingenious invention by which this is accomplished is due to Mr. St. George Lane Fox, and is on trial at the station of the Gaslight and Coke Company at Fulham, where we recently inspected its practical working. The arrangements by which a revolution in our public lamp-lighting promises to be effected consists, in the first place, in connecting the lamps together by conductors, consisting of insulated metallic wires. By this means an electric current, generated at a station or central point, operates simultaneously upon every lamp through the instrumentality of an apparatus attached to each lamp. The apparatus constitutes the special feature of Mr. Fox's invention. It is difficult without drawings to describe precisely this ingenious piece of mechanism, but broadly it may he stated to consist mainly of a soft iron core, around which is a coil of insulated wire, thus forming an electro magnet. The wire of this electro magnet forms part of the electric circuit by which the lamps are connected, and constitutes in itself a primary coil. Around this primary coil is wound a secondary coil of fine wire of much greater length. We thus have an induction coil and a fixed magnet, which can be magnetized so as to render its poles reversible at pleasure. Above this fixed magnet is a permanent steel magnet, which, however, is moveable, being free to turn on a needle point forming a vertical axis, thus affording it the means of developing a reciprocating horizontal motion when actuated. These magnets are carried in a small metal framing, having a passage through it for the gas to pass to the burner at the top, and being provided

with a stop-cock, which is actuated by the reciprocating magnet. The whole of this apparatus is inclosed in an air-tight metallic case, and is only about 2½ inches high, and 2½ inches wide at its greatest width, and is screwed on to the supply-pipe in the lamp, the conductor being carried down the interior of the lamp-post and laid underground, except where an overhead line is admissible.

This apparatus has two functions, one being to turn the gas on and off, and the other to light it at the point of the burner. The former is accomplished by opening and closing the stop-cock by means of what may be called an electric needle-tap, and the latter by the induction coil, the whole, however, being in combination. The plug of this needle-tap is cylindrical, about three-eighths of an inch in diameter, and is carried in a socket which it fits rather loosely. It is made to turn in this socket by the action of the reciprocating magnet, a couple of studs on which are brought into contact with a small pin connected with the plug, and forming, in fact, the handle of the stop-cock. The annular space between the plug and the socket—which is about the one-thousandth part of an inch—is filled with oil, which is retained by capillary attraction between the two surfaces, the joint being thus rendered perfectly gas-tight. The oil of bitter almond is used on account of its non-oxydizable character, and from the power it possesses of resisting the action of very low temperature. Such is the apparatus designed by Mr. Fox, in which it will be seen that a very special feature is the introduction of a fixed core which can be magnetized so as to render its poles reversible at pleasure, and, in conjunction with it, a moveable magnet, the polarity of which, however, is permanent.

We have now described the means whereby this apparatus is rendered active and the method of operating with it as witnessed by us on our visit to the Fulham station. Assuming a group or series of gas-lamps to be connected by a conducting wire, the ends of the wire from this circuit are connected with a switch, which is simply a little piece of mechanism for placing the circuit in communication with, or disconnecting it from the battery. An electric current is first sent through the circuit from an ordinarily powerful telegraph battery. The result is that the soft iron core in each apparatus becomes converted into a temporary magnet, and the permanent reciprocating magnet above it is made to turn upon its axis. In performing a partial revolution the projections upon it engage with the pin or handle of the stop-cock, and, turning that around, open the cock and admit the gas to the burner. The battery is then disconnected from the circuit, and a condenser is charged by means of a Rumkorff coil, and then discharged through the circuit. The result is that an independent electric discharge is induced at the burner of every lamp at the same moment, and the gas is ignited by means of a pair of metallic points, which are connected with the secondary coil, and which deliver the spark. To extinguish the light the wires are reconnected with the battery by the means of a switch, but in such a manner as that a reverse current is obtained. The

permanent magnet of each lamp is thus caused to return to its normal position, and in so doing it again acts on the pin of the stop-cock and thus turns off the gas.

This system was introduced by Mr. Fox at the Fulham Station about eight months since, and altogether forty lamps scattered about in various parts of the company's extensive premises have been used to test the principle. About two months ago the number connected up was reduced to twenty-three, in order to enable the company's engineer, Mr. F. McMinn, to make an official trial of the system by direction of the governor and directors of the company. The trial ranged over six weeks and in its results enabled Mr. McMinn to report most favorably upon the merits of the system. For all practical purposes, however, the invention may be said to have had an eight months' trial.—*London Times.*

CAUSES OF EXPLOSIONS IN MINES

Mr. W. Galloway, in *Nature*, has the following seasonable remarks on this subject:

Before the invention of the safety lamp, the only means of guarding against the ignition of firedamp consisted in the employment of an apparatus called the "steel mill." The light obtained by its aid was feeble and uncertain, and Mr. Buddle informs us that explosions were known to have been caused by the sparks emitted by it. When Davy made his brilliant invention in 1815–16, the steel mill was laid aside for ever, and it was then imagined that colliery explosions had almost become phenomena belonging to a past order of things. So confident, indeed, was Davy in the efficacy of his lamp, that he believed it could be safely employed for carrying on work in an explosive atmosphere. But one explosion followed another in an unaccountable manner; and a select committee was appointed in 1855 to inquire into the nature of accidents in mines. In 1850 Mr. Nicholas Wood made a series of experiments, which proved that when a Davy lamp is subjected to an explosive current traveling at the rate of 8 or 9 feet per second, the flame soon passes through the wire gauze. This was corroborated about 1867 by experiments conducted by a committee of the North of England Institute of Mining Engineers. In 1872–73, the writer demonstrated, also by experiment, that when a lamp burning in explosive gas is traversed by a violent sound-wave, such as that produced by a blasting shot, the same result follows, that is, ignition is communicated to the outside atmosphere.

The atmosphere of a part of a mine may become explosive before the men escape, either by the sudden influx of a quantity of firedamp from some natural cavity in which it had existed in a state of tension, or by a partial or total cessation of the ventilating current; and I propose to consider how such an event could produce an explosion, supposing all the men to be provided with safety-lamps. This will happen (1) if the inflammable gas passes over a furnace at the bottom of the upcast; (2) if it is carried against

a Davy and Clanny lamp at a greater velocity than 7 feet per second, or if the lamp is traversed by a sound-wave; (3) if a blasting shot is fired directly into it; and lastly, if it reaches a safety-lamp that has been opened by one of the men.

The means that have been provided for guarding against these contingencies are as follows:—(1) Furnaces have to a large extent been replaced by ventilating fans in fiery collieries. (2) Davy and Clanny lamps are still almost universally employed. (3) Shot-firing, having been found to originate many explosions, although probably in a manner not yet understood by most people, is now carried on under certain restrictions which are still insufficient. (4) Much nonsense has been talked and written about miners opening their lamps. The present flimsy pretense for a lock is not a necessity but a cheap convenience; and who is responsible, if, say 100 men are killed through its being opened by one? Is there no responsibility attached to the owners or the legislature for placing the lives of ninety-nine innocent men in danger? I think there is. The influence of changes of weather on the internal condition of mines has been remarked since the remotest times, and for the last fifty or sixty years at least many have asserted that firedamp is more prevalent when the barometer is low than in the opposite case. When vigorous artificial means of ventilation are employed, and ordinary skill practiced in distributing the air the effects of change of weather become much less perceptible. If a large proportion of explosions can be shown to occur simultaneously with, and therefore, presumably, in consequence of, those atmospheric changes that would tend augment the amount of firedamp in the workings, there is a strong argument in favor of the supposition that they are preventible, and cannot therefore be considered as accidents in the true sense of the term. With this object in view, diagrams have been made from time to time by Mr. R. H. Scott and myself, and also by one or two others, showing the connection that exists between the two classes of phenomena, and an examination of these is sufficient to convince unbiased persons that there is a striking coincidence between the explosions and the favorable atmospherical conditions. A general rule was inserted in the Coal Miners' Regulation Act (1872) making it compulsory for mine-owners to place a barometer and thermometer at the entrance of every mine in the coal measures. It has always been difficult, and sometimes impossible, for mining men to give an adequate reason for the extent of great explosions; and more especially when it is known that, immediately beforehand, little or no inflammable gas has been present in the workings. The reports of the Inspectors of mines bear ample testimony to the correctness of this statement. In September, 1844, before the appointment of inspectors of mines, Lyell and Faraday were sent to Haswell Colliery by the Home Secretary to report on an explosion that had just taken place there. I am unable to quote from their official report, but I am firmly convinced that the following sentences taken from their article on the subject in the *Philosophical Magazine*, 1845, is the

true key to a solution of the problem as regards both the mode of occurrence and means to be used for the purpose of avoiding great explosions in future. The sentences referred to are these:—" In considering the extent of the fire for the moment of explosion, it is not to be supposed that the firedamp is its only fuel; the coal dust swept by the rush of wind and flame from the floor, roof, and walls of the works, would instantly take fire and burn, if there were oxygen enough in the air to support its combustion; and we found the dust adhering to the face of the pillars, props, and walls in in the direction of, and on the side towards the explosion increasing gradually to a certain distance as we neared the place of ignition. This deposit was in some parts half an inch, and in others about an inch thick; it adhered together in a friable coked state; when examined with the glass it presented the fused round form of burnt coal dust, and when examined chemically, and compared with the coal itself reduced to powder, was found deprived of the greater portion of bitumen, and in some cases entirely destitute of it." About three years ago M. Vital, Ingenieur des Mines in France, showed that a flame resembling that produced by a blasting shot which blows out the tamping is greatly lengthened in an atmosphere containing a cloud of coaldust; and soon afterwards the writer ascertained that air containing a small portion of firedamp (less than one per cent. by volume) becomes highly inflammable when coal dust is mixed with it. These discoveries complete what Lyell and Faraday began, and show how explosions of any conceivable magnitude may occur in mines containing dry coal dust. A blasting shot or a small local explosion of firedamp, or a naked light exposed when a cloud of coaldust is raised up by a fall of roof in air already containing a little firedamp, is sufficient to initiate them, and when once they are begun, they become self-sustaining. Out of many hundred colleries known to me, there is not, to my knowledge, a single damp one in which a great explosion has happened; while, on the other hand, there is a considerable number of very dry ones in which explosions, causing the deaths of from 12 to 178 men at a time, have occurred.—*Engineering and Mining Journal, Jan. 5th*, 1878.

THE SPRINGS OF SOUTHERN NEVADA.

BY D. A. LYLE, U. S. A.

It is the intention of the writer to merely jot down a few personal recollections of some of the springs visited in the arid region of Southern Nevada, while a member of one of the Wheeler expeditions.

To those who have experienced the pangs of thirst while journeying over the desolate wastes that characterize this section, it will not be surprising that reminiscences of water should linger longest in the memory of the traveler. In fact the procurement of that necessity is a matter of such vital importance that all movements are subordinated and controlled by the answer to the question, "Is there any water there?" Should the

reply be in the negative, some other route must be followed, or else a supply of water must be carried along. The springs in this portion of the Great Basin are few, and often far between. Their waters differ much in quantity, temperature and chemical composition. In quantity, the yield varies from a few gallons per day to a never failing supply. As to temperature, the heat of the waters range through cold, cool, tepid and warm to boiling. As regards chemical composition, some are fresh, others alkaline, and still others, sulphurous. In the waters of some springs, a mere trace of saline ingredients are found, while in other cases the salts are present in sufficient quantity to produce saturation.

The first that will be mentioned are Mud Springs, also known as Desert Wells, from the fact that parties passing that way, have dug pits from four to eight feet deep when there, in search of more water. These springs, when visited by the writer, were mere pools of muddy slime, with a slight film of stagnant water overlying the viscous blue marsh. So nauseous were these waters that neither men nor animals could drink them. Enough water, however, was obtained by digging new pits or "wells" near by, to partially alleviate the sufferings of man and beast, which were somewhat intense after marching over thirty miles through the heated sands of the Smoky Valley Desert upon a July day.

These springs—if springs they may be called—were situated at the southern extremity of Smoky Valley, surrounded by a dreary waste of sand and "alkali flats," with here and there a stunted sage bush.

Day break the following morning found the party en route to Silver Peak, the next objective point. Silver Peak, a small mining camp, is located near the west side of Clayton Valley, and at the eastern base of the Red Mountain range. Near this place and along the western border of the salt marsh which forms the major part of the basin are the Thermal Springs. The more important ones are eleven in number. With one exception they are contained in a narrow belt, running almost north and south. This belt is about a half mile in length, its width being but a few rods. Beginning at the southern limit of this line, the first spring we encounter is in a small depression in the general surface. Its waters are slightly saline, but quite palatable, and are the best for use in the vicinity. The temperature of the water is 69° Fahr. Just north of this is found a cluster of springs; the largest and most central one is called Saturn. Their temperatures are 69.5° Fahr. These springs are in close proximity to each other, and flow out upon a level area some twenty acres in extent, covered with a rank growth of coarse salt grass, from whence the water flows into the salt marsh.

Proceeding northward, we next meet with three salt springs arranged in the form of an isosceles triangle, differing widely in temperature and the degrees of their saturation.

These are situated in the edge of the salt marsh, the two forming the base, being in an east and west line, twenty feet apart. The more westerly one has a temperature of 79° Fahr., while the other one in its quiescent

state has a temperature of 117.8° Fahr., and at irregular intervals boils and emits steam. The third, forming the apex of the triangle and lying ninety feet north, has a temperature of 116.5° Fahr.

Still further north are two more salt springs, situated also in an east and west line, only four feet apart; the westerly one, as before, having the lowest temperature, being 79° Fahr., while the other has a temperature of 117° Fahr. Another spring, about one-fourth of a mile north of the others, was constantly boiling and emitting steam. A gurgling noise could be heard in several places near the main opening, under the tufaceous crust of calcareous matter deposited by its waters. In approaching this spring the greatest caution had to be exercised to avoid breaking through the crust of tufa which bridged and in part, concealed the seething waters, which could be seen through the many perforations in this treacherous envelope. Every step in advance was carefully treated by striking the tufa with a mining hammer, to see if it would bear the weight of a man. Thus, by slow degrees one or two members of the party succeeded, without accident, in reaching the main opening, which was about five feet in diameter. Regard for personal safety, however, soon overcame scientific curiosity, and the retreat was accomplished by separate routes in the same cautious manner, to avoid getting too much weight upon any one place. The waters were found to be impregnated with soda, lime and borax.

In the immediate vicinity of the hot springs were found numerous concretions, either on the surface or slightly imbedded. These had generally a prolate spheroidal form, although many eccentric shapes were seen. About half a mile out in the salt marsh was a remarkable spring, nearly twenty feet in diameter. The water rose to the height of several inches above the general surface, and was retained by a ring of earth elevated a foot above the terrain and thickly set with *tules*, a kind of rush, whose verdancy contrasted strangely with the sombre gray around, and gave to it the appearance of a miniature oasis. The water was quite clear and nearly fresh; this latter property was probably only apparent from the contrast, after imbibing the more brackish water of the other springs; its interior cylindrical walls extended to a depth of about five feet, below and under which, as far as could be reached by a pole, nothing like earth could be felt. There appeared to be a subterranean lake beneath the salt marsh, of which this spring was the only visible portion. As to its depth we had no means of determining it; the temperature was 69° Fahr. The circumjacent earth was a mere superficial crust, five or six inches thick, which was springy beneath our tread, and breaking through which one sank into the viscous mud. In walking over this area the ground constantly jarred and trembled, thus indicating the elasticity of the indurated envelope. Even on the road near our camp, west of the marsh, when animals traveled over it, a dull, hollow sound was heard, bearing out the hypothesis of the existence of a subterranean cavity. The plain is crossed in two or three places by roads and trails; and should animals get off these, they break through and often

become submerged in the mire. At one or two places shallow trenches or vats have been scooped out, and the salt water collecting and evaporating in them leaves the walls and bottoms covered with beautiful crystals of pure salt.

Traveling westward from Silver Peak, a distance of eleven and three-fourth miles, during which the Red Mountain range is crossed, Mountain Spring is reached. This spring bubbles up at the foot of Red Mountain peak. The water is clear, cold and not in the slightest brackish. Its appearance was hailed with joy by men and animals. At last water had been found that would slake instead of increasing thirst. Here, in the short interval of less than ten miles, the physical characteristics of the water supply had radically changed.

On the east side of the Red Mountain range the springs were thermal, brackish, and often nauseating, while on the western slope they were pure, cold and refreshing.

A few miles west of Red Mountain Spring, in a dry ravine, through which the traveler passes to reach Fish Lake Valley, is found Mamie Spring. The water is excellent and plentiful. Its situation is rather unique. In the bottom of a dry wash lies a very large boulder of conglomerate, or more strictly of breccia, transported from some distance, from the under side of which the water of the spring gushes into a little pool or basin it has made for itself. From this basin the water, overflowing, traverses for a few yards the gravelly bed of the wash, when it sinks and is seen no more. The huge boulder that shadows this little basin with its overhanging edge is mainly composed of a very hard arenaceous matrix, in which are seen imbedded many rounded pebbles of various sizes, and also large angular fragments of rock. The most remarkable thing about this spring was the fact that it had only been running about two years, having suddenly sprung into existence, the miners said, since they had been in the vicinity.

Upon the eastern edge of the Amargoza Desert is quite a large area called Ash Meadows; so named from a small species of ash tree growing there. The meadows are covered with good grass and are well watered by numerous warm springs.

The principal spring was about thirty feet in diameter and situated at the foot of a small butte. The water issued from the bottom, through a tufaceous mass of rock.

It was about four or five feet deep, and was cooler than the other springs. The stream of water that flowed out was five inches deep and two feet wide, and clear as crystal. The sides and bottom of this spring were covered with a white, chalky-looking deposit, that gave a milky tinge to the water when stirred up. A few small fish were seen in this spring. Many of the springs in this vicinity contained quicksand.

Southeast of Amargoza is Pah-rimp Desert. About the middle of the upper end of this dreary waste of sand and sage bushes are several little

oases bountifully watered with exhaustless springs, some of which are very large, and the confluence of their waters form quite a large creek that flows off towards the southwest, but is soon lost in the sand. Splendid grass abounds all along the banks of this water course. Immediately around the springs a band of southern Pah-Ute Indians is located, and by irrigation succeeds in raising a quantity of corn, squashes and watermelons. Willow trees and wild grapes are indigenous, the latter growing in the greatest abundance.

Mound Springs. By this appellation it is proposed to designate those springs situated upon small mounds rising above the general surface of the country surrounding them. The most prominent mound noticed by the writer was upon the Vegas plains in Southern Nevada; its base was circular and about twenty-five feet in diameter, it was fifteen feet in height and was covered with "*tules*" and coarse grass. Several small sulphur springs oozed from its nearly flat top, and provided moisture for the tangled vegetation.

It appeared as if built up by the partial decay of organic matter and the depositions of these numerous springlets. The soil was tremulous and yielding to the tread, and resembled in that particular the sphagnous bogs of Alaska. The fumes of sulphuretted hydrogen were strongly apparent even at some distance from the mound.

A short distance beyond the mound above mentioned, occurred the Las Vegas Springs, the largest of which was apparently about three feet deep, with white quicksand constantly "boiling up" from the bottom. Quite a large creek issued from it and ran in a southeasterly direction for a mile or more. This spring had been regarded by the Indians and squatters as a rather supernatural one, and among other improbable legends was said to be bottomless. This myth, at least, was exploded when a sixty pound weight tied to a cord was used to sound its depth. This weight sank eighteen feet and three inches through the ever varying quicksands, and then came to rest. Further on ran the other springs, which also poured their waters in the creek flowing from the first one. On the left bank of this creek stood an old *adobe* enclosure, rectangular in shape, built by the Mormons some years before.

Two or three long cottonwood trees shaded the creek near the quadrangle. Here the bed of the stream was broken into a series of little rapids or falls, none exceeding four feet in height, formed by rocks of calcareous tufa.

At the foot of these miniature waterfalls was a quiet pool, about five feet deep and ten feet in diameter, used in former times by the Mormons as a baptismal font. The land along the banks of the creek had been cultivated, and at this time were seen the remains of irrigating ditches, which attest the industry and enterprise of this strange, and to our minds, deluded people. These fields are now overgrown with mesquite and thistles, the latter attract numberless goldfinches, humming birds and bumble bees.

In the springs above enumerated, the reader has a sketch of a few of those in Southern Nevada. The springs of this inhospitable region are so few, that at one time or another, each one becomes, as it were, the polar star of the desert traveler, towards which he turns his face with inflexible determination.—*American Naturalist.*

GROWTH OF MINERALS.

BY G. C. BROADHEAD.

Your paper some time since, also of date 22d inst., contains notices of Mr. Redwin and mineral growth. Although his specimens must be quite interesting forms of crystallization, still I do not see that his proof is conclusive—at least of a growth like unto that of either plants or animals.

Does he observe a mineral start from a root-stock, and gradually increase and expand, both in length and breadth, like plants do when they receive nourishment? Can minerals during their growth (?) receive nourishment like plants and animals, and vivify under the influence? If all these things are proven, then his minerals may be said to grow; and when nourishment is withdrawn, they would lose their brilliancy, die and change their organic (?) structure. Do his minerals do so? If they do not then his theory is not proven. We all know that by exposure, certain minerals oxidize more rapidly than others; but this could not be said to be loss of life, as understood among plants and animals Nevertheless there are certain peculiarly interesting forms of crystallization that rather puzzle us as to how or why they appear so.

Minerals have their own peculiar structure of crystal. Some at times present a fibrous structure, which may be likened to growth.

Why is it that the Millerite occurs in extremely fine hair-like crystals shooting as it were from the base of pearl spar crystals into and through calcite, as they do in specimens in my cabinet? Specimens show it starting forth in divergent lines, and also somewhat fasciculated.

I also have specimens of needle-like crystals of Gœthite radiating from the base of calcite crystals, sometimes penetrating and passing through them. I have them also penetrating quartz crystals. But a most interesting specimen in my collection is of smoky quartz from North Carolina. It is of a deep rich color, yet beautifully transparent. It is about four inches thick, but passing entirely through it is a fascicle of hair-like crystals of rutile, .1¼ inches wide by ¼ inch thick. Other single hair-like crystals traverse it in other directions, but are easily traced throughout. For these I could detect no point of departure as in Gœthite and Millerite. Very pretty specimens are those from Cumberland, Rhode Island, of quartz showing acicular crystals of Hornblende traversing it in various directions, but each seeming independent of the other.

Barytes is often found in Missouri, showing pipe iron ore traversing it; but in this case the iron ore is stalactitic, it being formed first and afterwards surrounded by baryte.

Minerals are often seen occupying drusy cavities—attracted to the sides of the cavity—the points of crystals directed towards a central place. These have evidently crystallized from mineral solutions as can be proven in a chemical laboratory. Loaf sugar can be crystalized, but no organic growth can be detected. I collected at Oronago, Jasper county, many specimens of chert, all showing that they had been blasted out within a few years past by the miners, but at that time this locality was abandoned. Many had small, waxy looking globules adhering to their surface, some attached to the evidently recent fractured rock. Analysis proved them to be carbonate of zinc. This I think is a proof that minerals are forming; that is, being *crystallized now as well as long since.*

I have before me a stalactitic form from a cave in Galena, Kansas, showing a central nucleus of claystone; next to and nearly surrounding it is the white aggregation of small stalactites, about $\frac{3}{4}$ of an inch long and terminating in hollow-rounded points—the deposit of the last drop of solution. Next to this aggregation, and apparently a continuation of and adhering to the stalactitic mass and radiating beyond for a $\frac{1}{2}$ inch to 1 inch, is a collection of numerous minute white hair-like calcite crystals. At one side the stalactites we know have been formed by regular dripping in water holding calcareous matter in solution, and the whole stalactitic mass presents the phenomena of stalactites attached to each with crystals apparently emanating from them. The presence of the crystals can most probably be explained by the cave becoming filled with water containing much calcarious matter, since the period when the stalactite was formed.

Geologists are familiar with the fact that minerals often crystallize around fossils, or some hard substance in turn forming a concretion.—*Mines, Metals, Arts and Railroad Journal.*

ST. LOUIS ACADEMY OF SCIENCES.

The Academy of Sciences held its twenty-second annual session January 7, 1878, at the Polytechnic Hall, with twenty-three members present. In the absence of Prof. C. V. Riley, Dr. Forbes was called to the chair.

Judge N. Holmes, the Corresponding Secretary, submitted a number of letters from various points. Under the call for donations, Judge Terry presented to the Society the original draft of Mr. Ira Stout's air ship. Mr. Stout had promised to be present at the meeting and give the members his views on ærostation, but having received an urgent call from Indianapolis, had been obliged to leave the city. Judge Terry also laid before the Society a fine specimen of septarium formation, found by him at the Hot Springs.

Prof. Riley, who had in the meantime arrived, laid before the body a paper on mite transformations, which was referred to the Publication Committee; also a note on ocean gulls.

Prof. Nipher handed in a report upon the earthquake of November last, together with a chart describing its boundaries, prepared by Prof. Gustavus Heinrichs, of the Iowa weather service. The report showed that the earthquake of November 15 had extended from Julesburg, Col., to La Crosse, Wis., and from Olivet, D. T., to Topeka Kas. The territory disturbed forms an elipsis, the minor axis of which measures over 300 miles from N. N. W. to S. S. E., while the major axis extends from W. S. W. to E. N. E. over 600 miles, and comprises fully 150,000 square miles. The greatest energy of the earthquake was manifested along the Missouri River from Yankton to Sioux City, at 11:30 a. m., and along the Platte River, from Columbus to Omaha, at 11:40. The principal shock reached the eastern, southern and western limits about 11:50. From these data follows a velocity of transmission of fully 600 miles per hour.

Judge Holmes submitted his annual report, showing on the list of exchanges with the Academy 221 foreign publications, and 100 emanating from various societies within the United States.

The Librarian made his report, in which a condition of affairs not altogether creditable to the society was set forth. There were 2,676 volumes and 4,100 pamphlets catalogued, but they were in bad condition generally, and deserved the attention of the Academy.

Dr. Enno Sander, Treasurer, reported expenditures during the year amounting to $668, with receipts falling short of this amount. He took the occasion to refer to dilatory members whose dues were unpaid.

The Board of Curators and Committee on Library submitted brief reports.

President Riley read his annual report, which was a comprehensive and interesting document, setting forth the progress of the society through a period of twenty-two years, the hardships that had been met and overcome, and the obstacles that still stood in the way of the permanent success of the Academy. There were 110 members on the rolls of the Academy, twenty-four of whom had been elected during the past year. In addition to these there were 143 corresponding members.

The Academy then proceeded to the election of officers for the ensuing year. Mr. Pulsifer nominated Dr. George Englemann, and Judge Holmes Prof. Riley. The latter gentleman stated that he had occupied the chair of presiding officer for two years, and believed, under the rules a re-election was not permissible. At all events he would decline. Dr. Engelmann was elected president without opposition, the Recording Secretary casting the vote of the Academy.

The other officers elected were as follows: 1st Vice President, Prof. Riley; 2d Vice President, Silas Bent; Treasurer, Dr. Enno Sander; Corresponding Secretary, Judge Holmes, Recording Secretary, Prof. Nipher; Librarian, Prof. E. M. Crunden; Board of Curators, Dr. G. J. Engelmann, Dr. Hambach, and Mr. Hilder.

Mr. John Goodin was chosen an associate member of the Academy.

METEOROLOGY.

KANSAS WEATHER REPORT, DECEMBER, 1877.

BY PROF. F. H. SNOW.

STATION—Lawrence, Kansas, corner of Tennessee and Pinckney streets; elevation of barometer and the thermometer 875 feet above the sea level and fourteen feet above the ground; anemometer on the University building, 105 feet above ground.

The month was remarkable for its high temperature and excessive cloudiness.

Mean temperature 44°.43, which is 5°.20 above that of November, and 16°.31 above the December average of the nine preceding years. The next warmest December on our record was in 1875, with mean temperature 39°.35. There were only two days whose mean fell below the freezing point; in December, 1876, there were 24 such days. The highest temperature was 68°, on the 12th; the lowest was 10°, on the 1st: range of temperature, 58° Mean at 7 a. m., 38°.79; at 2 p. m , 51°.22; at 9 p. m., 43°.87.

Rain and melted snow, 2.21 inches, which is 0.36 inches above the December average. Either rain or snow fell on ten days. The entire depth of snow was only half an inch, which fell on the 29th; there were snow flurries on the 5th. There were two thunder showers—on the 16th and 17th. The total rainfall for the year 1877 has been 41.09 inches.

Mean cloudiness, 58.17 per cent. of the sky, the month being 9.21 per cent. cloudier than usual. Number of clear days, 12; (entirely clear, 4); half clear, 5; cloudy, 14 (entirely cloudy, 9). There were six entirely cloudy days in succession. Mean cloudiness at 7 a. m., 64.84 per cent.; at 2 p. m., 59.03 per cent.; at 9 p. m., 50.64 per cent.

Wind—S. W., 33 times, N. W., 24 times; S. E. 11 times; N. E. 9 times; N., 8 times; S. 3 times; E., twice; W., once; calm twice. The entire distance traveled by the wind was 10,683 miles, which gives a mean daily velocity of 34.6 miles, and a mean hourly velocity of 14.36 mile. The highest velocity was 45 miles an hour on the 29th.

Mean height of barometer, 29.191 inches; at 7 a. m., 29.208 in.; at 2 p. m., 29.167 in.; at 9 p. m., 29.196 in.; maximum, 29.575 in., on the 8th; minimum, 28.596 in., on the 4th; monthly range, 0.979 in.

Relative humidity—Mean for the month, 74.4; at 7 a. m., 83.12, at 2 p. m., 62.3; at 9 p. m., 78.8. Greatest 100, on several occasions; least, 30.7 at 2 p. m., on the 2d. There was no fog.

The following is a copy of a portion of the daily record of temperature, direction and velocity of wind, face of sky, humidity and rainfall:

Date.	Temperature. 7 A. M.	2 P. M.	9 P. M.	Mean.	Direction of Wind.	Miles of Wind.	Face of Sky.	Mean Humidity.	Rain Fall.—Inches
1	10.0	36.0	26.0	24 5	S W	50	C'ear,	69.8	.....
2	24 0	49.0	40.0	38.2	S W	475	Clear,	52.1	.....
3	36.0	37.0	41.0	38.7	S W	434	Cloudy,	97 7	1 25
4	40.0	39.5	35.5	37.6	N W	202	Cloudy,	76.7	.....
5	31.0	33.5	31.0	31.6	N W	747	Cloudy,	77.4	0 10
6	27.0	42 0	36 0	35 2	N W	525	Half clear,	68.1	.....
7	28.0	49.5	31 5	35 1	N W	323	Clear,	67.8	.....
8	26.0	44.5	34 0	34 6	S W	59	Clear,	64 3	.....
9	36.0	56 0	35.0	40.2	S W	596	Clear,	49.3	.....
10	36.0	57.0	54 0	50 0	S	384	Half clear,	55.3	.....
11	42.0	67.5	57.5	56 1	S W	475	Clear,	55 5	.....
12	44.0	68 0	43.0	49 5	Var	515	Clear,	60.3	.....
13	33.0	55 0	35.5	39.7	N W	181	Clear,	64 6	.....
14	34.0	58.5	51 0	48.6	S W	252	Clear,	63.3	.....
15	51.0	65.5	59 5	58.8	S W	363	Clear,	55.5	.....
16	59 0	64.0	60 0	60.7	S E	70	Cloudy,	85.4	0.01
17	60.0	63 0	62.0	61 7	S E	222	C'oudy,	92.2	0.40
18	58.0	63.5	62 0	61 3	S W	333	Cloudy,	83.7	0.05
19	56.5	62.0	60 5	59 8	S W	343	Ha f clear,	83.4	.....
20	46.5	65 0	55 5	55.6	S E	242	Clear,	76.8	.....
21	48.5	64 0	56.0	56.1	S E	424	Half clear,	80.2	.....
22	52 0	60.0	52.5	54.2	S W	363	Cloudy,	84 1	0 15
23	43 0	54 5	43 0	45.8	N W	171	Half clear,	75.7	.....
24	37 0	53 0	44.0	44.5	N E	131	Cloudy,	72.9	.....
25	37.0	40 0	38.0	38.2	N E	404	Cloudy,	84.7	0.02
26	37 0	43 0	40.5	40 2	N	51	Cloudy,	98.9	0 01
27	40.9	42 0	39.5	40.2	N E	101	Cloudy,	86.7	0 02
28	36.0	39.0	37.5	87.5	N	161	Cloudy,	85.7	.....
29	34.5	35 0	32.5	33.6	N W	646	Cloudy,	96 5	0.20
30	30.0	35.0	34.0	33 2	N W	777	Cloudy.	80 8	.....
31	29.5	37 5	32 0	32 7	N W	192	Clear,	70.9	.....

MISSOURI METEOROLOGY FOR DECEMBER, 1877.

BY PROF. FRANCIS E. NIPHER.

MISSOURI WEATHER SERVICE,
CENTRAL STATION, January 4th, 1878.

The December just past was remarkable for its abnormal temperature. The mean at the Central Station being 45.6°, which is 12.4° above normal, and 2.7° above the normal November. At Lexington, a mean of 43.8° is reported.

At Troy, (Dec. 7), seeds of asters, hemp, mustard, etc., were observed germinating in open ground, as in April.

At Lexington and Clinton, rose, peach, lilac and other buds were unfold-

ing, and at the latter place, strawberries were reported in bloom. At Lexington, the eggs of the "fly" were hatching in large numbers in the wheat fields—(24th). A rainbow was seen at Clinton at 4 P. M. on the 22d, and half an hour later at St. Louis. Lightning at Poplar Bluff, 24th. At St. Louis, earth-worms came to the surface in immense numbers on the 24th, and frogs were heard on the 18th at Lexington and St. Charles.

The rainfall at St. Louis was 3.24 inches, a slight excess over the normal, which is 3.03. In the State, the rainfall was least in the northwest; being 1.30 at Corning, 1.68 at Hopkins, but increasing regularly towards the southeast, being 1.98 at Pleasant Hill, 2.70 at Clinton, 4.05 at Ironton, and 4.55 at Poplar Bluff.

At the Central Station, the highest temperature reached was 69° on the 12th, the lowest was 19° on the 2d. (At Lexington the maximum and minimum were 67° and 15°).

The total run of the wind for the month was 7,742 miles, an average of 250 miles per day. The highest daily run was 495 miles, on the 30th; the lowest was 117 miles, on the 17th.

Washington University, St. Louis.

ASTRONOMICAL NOTES FOR JANUARY.*

BY PROF. C. W. PRITCHETT, GLASGOW, MO.

VENUS.—In the telescope, Venus is now a sharp and beautiful crescent, closely resembling the Moon seen in twilight when four days old. Along the *inner* edge of the crescent are numerous irregularly shaped notches, which plainly reveal the inequalities of her surface. Though her illuminated surface is constantly *diminishing*, she will continue to grow *brighter* to us, till January 16. This is because her *distance* from us is constantly diminishing. After this date she will diminish in brightness till February 20, when she will be in inferior Conjunction, and consequently *invisible* to us. Soon after this latter date, she will reappear in advance of the Sun, as the Morning Star.

MARS.—Mars is now near the Meridian at sun-set, and appears wonderfully shorn of his recent glories. Micrometer measures of his diameters, both from east to west and from north to south, made here about Sept. 1st, gave about 25.5″ of arc. His diameters have now fallen to 8.5″, showing that he is 3¼ times as far from us now as he was at opposition, Sept. 5. Still he is a conspicuous object in the southwest sky, in the early hours of the night. In the telescope, he still shows the vast accumulations of snow and ice near his south pole. Also the outlines of his seas and continents are still visible. But the change is *vast* from the splendid views he gave us in August and September. His opposition for 1877, will henceforth be *memorable* in the history of Astronomy. 1. For the *first time* his satellites

* This article was received too late for insertion under the proper heading.—[ED.

were revealed. 2. His physical markings have been accurately delineated at numerous observatories. 3. His relative mass is now known. 4. Observations on his position relative to fixed stars, will have an important bearing in the *final value* adopted for the Solar Parallax. A number of drawings showing the physical markings of Mars, were made at this observatory. Made at different hours of the night, they differ much among themselves, as *successive* parts of the planet were turned towards us. Some of these closely resemble the drawings of Mr. Lockyer, made for the opposition of 1862.

SATURN.—In early twilight, Saturn is now seen in the southwest sky, about 30° west of Mars, on the Ecliptic. The northern surface of his rings is still visible in large telescopes—the Earth being elevated only 2°+30′ above the plane of the rings. But an unpracticed observer would only note a sharp straight line extending across the ball to the distance of 18″ east and west. On February 6, even this *sharp line* will disappear, since the Earth will then be situated exactly in the plane of the rings. This disappearance will last till March 1, when the Earth will have crossed the plane of the rings, and will have attained an elevation of less than 1′ on the south side. This disappearance and reappearance of Saturn's rings, occurs every 14¾ years. During next year the rings will begin gradually to open again; but several years must elapse before the rings will *so open* as to present, even in powerful telescopes, their distinct and magnificent phases. The satellites of this planet still present a splendid retinue, and their conjunctions with the ends of the ring and the edge of the ball, have been closely observed at the Morrison Observatory, for the last two years. The observations may be seen in astronomical journals.

THE CONSTELLATIONS.—About 10 o'clock, Orion is just east of the meridian to the south. Farther north the Pleiades and Hyades have crossed it. Auriga, with the glorious star Capella, is nearing the zenith. Northward is Perseus in the variable Algol, and in the northwest Cassiopeia on her "royal seat." There is just then a marshalling of the "hosts of Heaven," which is excelled at no other hour of the year. Under the open canopy in such an hour even the naked-eye observer may well exclaim, "How marvelous are thy works, O Lord, Almighty." But to read those works as revealed in a powerful telescope, turned on such objects as Sirius with his faint companion—the Nebula in Orion—the triple star Andromeda, or the dual clusters in Perseus, like "diadems on the brow of night," is surely a privilege not lightly to be thrown away.

Morrison Observatory, January, 1878.

BOOK REVIEWS.

A GUIDE TO THE DETERMINATION OF ROCKS: Being an introduction to Lithology. By EDOUARD JANNETTAZ, Docteur es-sciences. Translated from the French by Geo. W. Plympton, C. E., A. M. D. A. Van Nostrand, Publisher, New York. For sale by Matt. Foster & Co. Price $1 50.

This is a duodecimo volume of 165 pages, intended by the translator, who is Professor of Physical Science in the Polytechnic Institute, Brooklyn, N. Y., as a desirable supplement to the ordinary Academic course of geology and an easy introduction to the larger treaties on Lithology. How far it will accomplish these objects depends largely upon the advancement made beforehand by the student in crystallography and microscopy, upon which to some extent the determination of rocks as taught in this work depends.—However, in most respects, it is plainly written, and well adapted to the wants not only of the class for whom it was prepared, but also for practical workers in the field.

The introduction is a concise description of rocks, divided into Crystalline, Sedimentary and Eruptive, their origin, formation constitution and modifications.

Part I. is devoted to the principal physical and chemical properties of the mineral species which compose the rocks, such as Feldspars and the minerals allied to them: the Micas, the Chlorites or talcose Micas; Talc and Steatite; Amphiboles, as Hornblende, etc.; Pyroxenes; Mineral species occasionally appearing as essential elements of rocks, like Topaz, Tourmaline, Garnet, etc.

Part II. is devoted to a description of rocks and the minerals which compose them, and consists of a more minute examination of the same classes or species named above with their dominating and essential elements and their accessory and accidental elements.

In Part III., the author first presents the prominent characteristics of rocks which enable the student to refer any specimen under consideration at once to a certain group, and after that gives the method of determining its precise order and name.

Part IV is translated from the elementary course of applied geology by M. Stanislaus Meunier, and gives the Dichotomic table for determining rocks.

As an illustration of the manner adopted by the author, we reprint part of the chapter descriptive of Metallic Rocks in Part II.

SULPHIDES AND SULPHO-ARSENIDES.

Heated on charcoal with carbonate of soda, they yield sodium sulphide which blackens lead paper or silver foil. Heated in the oxidizing flame, they yield sulphurous acids.

Galena.—Lead Sulphide (Pb S). Dominant forms: cube, octahedron, and a combination of these two; sometimes the facets of a rombododecahedron. It has three rectangular cleavages; a metallic lustre. Color: steel gray; powder: grayish black. It is easily fused. Heated on charcoal it gives a lead globule and yellow coating. With Potassic bisulphate it yields sulphuretted Hydrogen.

Varities; Laminated; foliated; granular; compact.

THE GEOLOGICAL RECORD FOR 1875. An account of works on Geology, Mineralogy and Palæontology, published during the year; edited by William Whitaker, B. A., F. G. S., of the Geological survey of England. London: 1877.

This is a valuable work of 443 pages, octavo, for the use of students and investigators, as it contains an account of all that has been published during the year on Geology, Mineralogy and Palæontology. It gives the name of the author, the title of the book or paper, where and when published, and in most cases a short abstract of their contents. The authors' names are arranged alphabetically under the different divisions of The British Isles, Europe, America, Asia, Africa, etc.; this, with a very full index, adds much to its convenience as a work of reference.

The cost of publishing this work is partially defrayed by a grant from the British Association, but yet the publishers feel the need of additional funds for the purpose of distributing it still more widely.

As a work of reference for Geologists, Mineralogists Palæontologists, it must necessarily be very valuable, and should be in every public library.

AROUND THE WORLD. By E. R. Hendrix, A. M., with an Introduction by Rev. Bishop Marvin: pp. 598, 12mo. Nashville: A. H. Redford; St. Louis: L. D. Dameron; 1878. For sale by Matt. Foster & Co., $2.00.

This is a Missouri book, witten by a Glasgow minister, who made a trip around the world in 1876 and 1877, for the general purpose of sight-seeing, and for the special purpose of examining for himself into the missionary work going on in foreign lands. Mr. Hendrix is endorsed by the late Bishop Marvin, of St. Louis, as "a first-rate traveler, thoroughgoing, painstaking, energetic, readily adjusting himself to new situations, and with a quick eye for new and striking facts, as well as that hearty interest in all human affairs which keeps him fully awake to all important events, and puts his powers of observation at their best."

Upon looking over this book we find it written in a sprightly and vivacious manner, at the same time giving descriptions of men and things observed in an accurate and attractive style. The author simply asks for the work a place in every Sabbath school library of the church, but it is entitled to a more prominent place than that, and will undoubtedly find it.

Starting at Kansas City, October 18, 1876, he describes his rapid course across the plains, the mountains, and the Pacific ocean, arriving in Yoko-

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hama December 1st. During the next nine months, he visited the principal points of interest in Japan, China, India, the Holy Land, Turkey, Greece, Italy, Switzerland, Germany, France and England, reaching New York August 17, 1877.

There is nothing profound in the work, and nothing perhaps very new to the scholar, but for family reading it is as acceptable and interesting as any of the kind lately put forth.

Being a strictly western book, and written by a well known and popular pastor of the Methodist church, it will undoubtedly have a large sale.

EDITORIAL NOTES.

DURING the holidays we made a flying trip out the Kansas Pacific Railway as far as Manhattan, and while there visited, under the friendly guidance of Mr. Stanton, of the Adams House, the State Agricultural College. Unfortunately for us, we found none of the Faculty of the College at home, but were well repaid for our visit after all. We were greatly surprised at the extent as well as the excellent quality of the means of teaching the youth of Kansas the various branches thought necessary in that liberal State for the education of its working class, such as cabinet making, the manufacture of agricultural implements, telegraphing, printing, practical geology and chemistry, music and sewing. The chemical department under Prof. Kedzie, is one of the most complete and best adapted to the purpose we have ever seen. Upon visiting the office of the *Industrialist*, which is edited by Prof. Anderson, we found several of the students busily engaged in setting type, and the quality of the work done by them is sufficient evidence that they are in the hands of good and faithful instructors in this department as well as all the others. Kansas has reason to be proud of its public schools, of all grades, from the University down to the District schools away out on the borders.

THE KANSAS CITY ACADEMY OF SCIENCE will hold its regular monthly session on the evening of January 27th, at which time an unusually interesting meeting may be expected. A paper upon "The Atmosphere" will be read by Col R. T. Van Horn, President of the Academy; one upon "Meteors" by Prof. Broadhead of Pleasant Hill; one by Miss Murdfeldt, of St. Louis, upon "Entomology." After which Prof. Crosby will display the very rare collection of curiosities brought home by him from Europe,

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THE Lecture upon the Telephone by Prof. Kedzie of the Kansas State Agricultural College, was necessarily postponed on account of the extremely disagreeable weather prevailing at the proposed time of its delivery. It will be delivered at an early day, illustrated by several large charts and twenty instruments.

WE are much gratified at being able to present in this number of the REVIEW the first of Prof. Pritchett's Astronomical Notes, and to announce that in the February number we shall publish an article by the same noted astronomer upon the *Occultation of Venus* with six fine illustrations of actual observation by him with the large telescope at Morrison University.

IT is extremely gratifying to western engineers that Capt. Eads has succeeded so completely in all his calculations and operations at the mouth of the Mississippi in spite of the predictions of failure by many of the promi-

nent army topographical engineers, and is now about to receive the second instalment of $500,000 due him.

THE next (February) number will complete the first volume of the REVIEW, and it may not be amiss to call attention to the fact that quite a number of those who have received it regularly during the year, are yet in arrears.

WITHIN the past few days a Mining and Stock Exchange has been organized in this city, which will soon be followed by smelting and refining works, and, it is not at all improbable by a branch of the United States mint within a short time

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PROF. SINKS delivered his third lecture upon Elocution before the Leavenworth Academy of Science, January 3rd, and from his well known reputation for ability and scientific attainments as well as from the newspaper reports of them, there is no doubt that they are both interesting and instructive.

THE young men of the High School and their associates, have recently started an attractive little periodical called the *Philomathean*, which, if kept up with the same ability manifested in the first number, will prove an interesting and beneficial work.

WE shall publish in our next number an exhaustive article on the subject of *Meteors* by Prof. Broadhead, which will be illustrated with engravings from photographs of some of the largest and most interesting which have fallen in Missouri.

AT this writing, January 12th, the weather is warm and pleasant. No ice has yet been harvested and cattle and other live stock have continued to graze in the open pastures, while but a few days since the fruit trees were budding forth, such annuals as Morning Glories were sprouting, and the Snap Dragons of last year were yet green in the flower beds.

THE cause of the late disastrous explosion in the candy manufactory in New York, has given rise to many explanatory theories. The most satisfactory seems to us to be that which attributes it to the sudden ignition of the cloud of starch particles floating in the air of the room where the explosion occurred. Such ignition of the finely powdered dust in coal mines is generally recognized as one sufficient cause of violent explosions occurring there, and we have all witnessed the same thing on a smaller scale when throwing a quantity of coal dust into a hot fire at our own homes; also, in the manufacture of stage lightning in theatres by the burning of lycopodium and other finely powdered substances.

NOTICES OF PUBLICATIONS RECEIVED.

Since our last issue we have added to our exchange list the JOURNAL OF THE FRANKLIN INSTITUTE, published by that body at Philadelphia. This is one of the oldest Scientific periodicals published in the United States, and has always maintained a high standing among such works. $3 per annum.

CAPT. HOWGATE of the *U. S. Signal Service* has favored us with a copy of a pamphlet recently published by him upon *Polar Colonization*, which is descriptive of the objects and purposes, as well as the actual transactions of the Preliminary Arctic expedition of 1877. We shall make use of the information furnished in our next.

THE January numbers of the various Scientific magazines have come to hand with at least their usual promptness, some retaining their former well known externals, and some considerably improved in appearance: all, however, fully maintaining their standards of excellence:

THE POPULAR SCIENCE MONTHLY, from which we reprint a very interesting editorial on "Sun Spots and their Effects," has a most attractive table of contents, and is well worth to any reader the five dollars per annum that it costs.

POPULAR SCIENCE MONTHLY—SUPPLEMENT—published by the same enterprising house, D. Appleton & Co, New York, presents monthly the choicest selections from the best European scientific journals. Price $3.00 per annum.

THE NORTH AMERICAN REVIEW, now in its 63d year, shows more brilliancy than at almost any other period of its existence, at the

same time that it has lost none of the scholarly ability which has always marked its articles. Its present editor, Allan Thorndyke Rice, evidently intends to keep it fully up to the times in every respect. Price $5.00 per annum

VAN NOSTRAND'S ENGINEERING MAGAZINE is one of those substantial, reliable journals that engineers and mathematicians most enjoy, being strictly technical and precise, and as purely scientific as anything published in either hemisphere. Price $5.00 per annum.

AMERICAN JOURNAL OF SCIENCE AND ARTS, being a continuation of what was so long known as Silliman's Journal. It is now nearly sixty years old, and is probably more widely known throughout the scientific world than any similar publication in the United States. Price $6.12 per annum.

THE ENGINEERING AND MINING JOURNAL, weekly, devoted to mining, metallurgy and engineering. It is ably edited by Professors Rothwell and Raymond, and is the only eastern scientific journal which gives any prominence to western mining matters; consequently it is a favorite throughout the west and on the Pacific coast. $5.00 per annum.

THE AMERICAN NATURALIST, devoted to the natural sciences in their widest sense, is also one of the standard authorities on all branches of Natural History, and has a corps of contributors unsurpassed for ability and scientific attainments. We have frequently, during the past year, availed ourselves of its columns for articles for the REVIEW. The office of publication has been changed to Philadelphia, beginning with the present number. Price $4.00 per annum.

BOSTON JOURNAL OF CHEMISTRY. Vol. 12, No. 7, edited by Prof. J. R. Nichols, M. D., and Wm. J. Rolfe, A. M., is deservedly one of the most popular periodicals published in the country, both from its low subscription price ($1.00) and the variety and value of its contents.

SCIENTIFIC AMERICAN. As we have before asserted in these columns, the *Scientific American* is an indispensable thing to mechanics, artisans, engineers, and to almost all classes of working people, whether they work in shops, laboratories, factories, or in the fields. It is admirably illustrated besides. Price $3.00 per annum.

MINES, METALS, ARTS AND RAILROAD JOURNAL, J. E. Ware & Co., St. Louis. This is a weekly journal, devoted to mines, metallurgy, chemistry, manufactures, technics, engineering, railroads and markets. It is edited with ability, and presents a most creditable appearance. To those desiring information on western mining and metallurgical matters, it will be found very useful. Price $2.00 per annum.

NEW YORK MEDICAL JOURNAL, edited by James B. Hunter, M. D. A., published by D. Appleton & Co. It stands high among Medical Journals and has on its list of contributors some of the finest and most able medical writers of the whole country. Price $4 per annum.

SCIENCE OBSERVER—Published by the Boston Amateur Society. Edited by J. Ritchie Jr., and associates. Devoted more especially to Astronomy. It is a modest paper in size, but manifests a good deal of spirit and talent in its articles. Fifty cents per annum.

THE PHRENOLOGICAL JOURNAL, now in its 66th volume, presents an improved appearance, at the same time that it has been reduced in price to $2 per annum. Many valuable articles are to be found in its pages.

WE receive the *Kansas Farmer*, the *Gardener's Monthly* and the *Quincy Agriculturalist* with the utmost regularity, and can heartily recommend them as most readable, reliable and valuable periodicals in their respective departments.

OF the literary Journals that we receive none excel Appleton's Journal and the Library Table, for valuable reading matter, whether for stories, critiques or editorial comments upon current topics.

IN addition to the periodicals and journals above noticed, we have received numerous others, which have been and are warmly welcomed by us, and which will have attention hereafter.

As remarked in our last number, we can furnish any one of the above named journals with the REVIEW at much less than the regular price of the two separately.